

N83447.AR.000200  
NAS FORT WORTH  
5090.3a

FINAL SUMMARY REPORT FOR REMEDIATION AT SOLID WASTE MANAGEMENT UNITS  
19, 20 AND 53 VOLUME 1 OF 4 WITH TRANSMITTAL LETTER NAS FORT WORTH TX  
2/17/1995  
DAMES AND MOORE

246 0



**NAVAL AIR STATION  
FORT WORTH JRB  
CARSWELL FIELD  
TEXAS**

---

**ADMINISTRATIVE RECORD  
COVER SHEET**

AR File Number 246

File: 17A-35  
A.F.  
246 24

---

VOLUME I  
FINAL SUMMARY REPORT  
REMEDATION PROJECT  
FTAZ = SWMUs 19, 20, AND 53  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS  
CONTRACT # DACA6393C0012  
for  
U.S. ARMY CORPS OF ENGINEERS  
February 17, 1995  
Dames & Moore Project No. 11851-010-135

---

 **DAMES & MOORE**

DALLAS



February 17, 1995

Mr. Todd Smith, P.E.  
Civil Engineer  
U.S. Army Corps of Engineers  
Fort Worth District  
701 Camp Wisdom Road  
Grand Prairie, Texas 75052

**Transmittal of Final Summary Report  
Remediation Project  
SWMUs 19, 20, and 53  
Carswell Air Force Base  
Fort Worth, Texas  
Contract # DACA6393C0012  
Dames & Moore Project No. 11851-010-135**

Dear Mr. Smith:

Dames & Moore, Inc. dba Dames & Moore CORE Services (Dames & Moore) appreciates the opportunity to provide Remediation Services to the U.S. Army Corps of Engineers (USACOE) at Solid Waste Management Units (SWMUs) 19, 20, and 53 at Carswell Air Force Base located in Fort Worth, Texas under Contract # DACA6393C0012. Within this submittal, Dames & Moore provides an original and 3 copies of the referenced Final Summary Report of remedial actions conducted at the site. This report is written in accordance with Section 01720 of the Project Record Documents subsection 1.0 General Requirements, Subsection 3.0 Submittals, and our conversation of Final Report Format of January 17, 1995. This submittal includes the following:

- Required Submittal Form 4025;
- Required Transmittal Letter;
- Synopsis of original Scope of Services;
- Synopsis of environmental work conducted;
- Copies of associated analytical data, chain-of-custody documentation, and tabular data summaries;
- Associated figures;

U.S. Army Corps of Engineers  
February 17, 1995  
Page 2

- Copies of manifests/shipping papers for soil movements;
- Site survey info and soil volumes; and,
- Listing of Record Documents (See Appendix B).

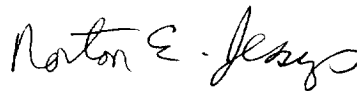
Within this submittal, Dames & Moore completes the obligations to the U.S. Army Corps of Engineers under Contract # DACA6393C0012 and requests a letter of completion and payment of any due funds from the USACOE.

oOo

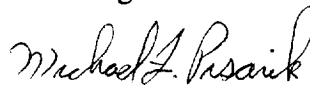
Dames & Moore appreciates the opportunity to be of continuing service to the U.S. Army Corps of Engineers on this project. If you should have any questions concerning this Final Summary Report, please contact me at your convenience.

Very truly yours,

**DAMES & MOORE, INC.**



Norton E. Jessup, P.E.  
Senior Engineer



Michael F. Pisarik, P.E.  
Associate

NEJ/MFP:tsd

Enclosure: 1 Original/3 Copies Final Summary Report  
Form 4025  
Associated Attachments

cc: Mr. Ken C. Hatcher, P.E., Contracting Officer, USACOE  
Mr. Jobie Smith, P.E., Area Civil Engineer, USACOE  
Mr. Allan Flolo, Base Engineer, Carswell Air Force Base

**TABLE OF CONTENTS**

	<u>Page</u>
<b>1.0 INTRODUCTION</b> .....	1
<b>2.0 BACKGROUND</b> .....	3
2.1 HISTORICAL INFORMATION .....	3
2.2 SITE LOCATION AND DESCRIPTION .....	5
2.3 SITE SETTING AND GEOLOGY .....	8
2.4 SITE HYDROGEOLOGY AND LAND USE .....	10
2.5 RESULTS OF PREVIOUS SITE INVESTIGATIONS .....	13
<b>3.0 SCOPE OF WORK</b> .....	15
<b>4.0 CLEANUP GOALS</b> .....	19
<b>5.0 WORK PLAN PREPARATION</b> .....	20
<b>6.0 REMEDIAL ACTIONS</b> .....	21
6.1 INITIAL SOIL DELINEATION SAMPLING .....	21
6.2 ASBESTOS CEMENT PIPING REMOVAL/DEMOLITION ACTIVITIES .....	22
6.3 BIOCELL CONSTRUCTION .....	23
6.4 SOIL EXCAVATION AND BIOCELL LOADING .....	24
6.5 SOIL EXCAVATION VERIFICATION SAMPLING .....	25
6.6 BIOCELL OPERATIONS .....	26
6.7 FLIGHTLINE DRAINAGE DITCH CONSTRUCTION .....	27
6.8 BIOCELL VERIFICATION SAMPLING AND DISMANTLEMENT ACTIVITIES .....	28
6.9 SITE RESTORATION, REGRADING AND RESEEDING .....	29
<b>7.0 CONCLUSIONS AND RECOMMENDATIONS</b> .....	30

**REFERENCES****FIGURES****TABLES****APPENDICES**

<b>REPORT FORMAT:</b>	<b>VOLUME I</b>	- Text, Tables, Figures and Appendix A
	<b>VOLUME II</b>	- Appendices B and C
	<b>VOLUME III</b>	- Appendices D, E, F and Part of G
	<b>VOLUME IV</b>	- Remainder of Appendix G

**LIST OF FIGURES**

<b><u>Figure Number</u></b>	<b><u>Description</u></b>
1	Site Vicinity Map
2	Site Location Map
3	Former Fire Training Area (SWMU 19 and 20)
4	Former Flightline Drainage Ditch (SWMU 53)
5	Initial Characterization Sampling Locations-SWMUs 19 and 20
6	Initial Characterization Sampling Locations-SWMU 53
7	Approximate Layout of Biocell
8	Verification Sampling Locations-SWMUs 19 and 20
9	Initial Baseline and Periodic Biocell Screening Sample Grids
10	Final Biocell Verification Sample Locations
11	Final As-Built Drawing and Drainage Plan-SWMUs 19 and 20
12	Final As-Built Drawing and Drainage Plan-SWMU 53

**LIST OF TABLES**

<b><u>Table Number</u></b>	<b><u>Description</u></b>
1	Previous Analytical Data Summary-SWMUs 19, 20, and 53
2	Initial Delineation Analytical Data Summary-SWMUs 19, 20, and 53
3	Verification Analytical Data Summary-SWMUs 19 and 20
4	Initial Biocell Baseline and Periodic Sampling Analytical Data Summary
5	Biocell Verification Analytical Data Summary

**LIST OF APPENDICES**

<b><u>Appendix</u></b>	<b><u>Description</u></b>
A	Chronology of Events
B	Listing of Record Documents
C	Laboratory Analytical Data Sheets and Chain-of-Custody Forms - Delineation Data
D	Asbestos Report and Manifest, Tank/Dumpster Destruction Forms, Soil Truckload Tickets, and Concrete Rubble Manifests
E	Laboratory Analytical Data Sheets and Chain-of-Custody Forms- Other Analyses
F	Laboratory Analytical Data Sheets and Chain-of-Custody Form - Verification Data
G	Laboratory Analytical Data Sheets and Chain-of-Custody Forms- Biocell Periodic and Final Verification Sampling

**U.S. ARMY CORPS OF ENGINEERS  
FINAL SUMMARY REPORT  
CARSWELL AIR FORCE BASE  
SWMUs 19, 20, AND 53  
REMEDIATION PROJECT**

**1.0 INTRODUCTION**

Dames & Moore, Inc. dba Dames & Moore CORE Services (Dames & Moore) has prepared this Final Summary Report on behalf of the United States Army Corps of Engineers (USACOE) and Carswell Air Force Base (CAFB) documenting the remediation program conducted at Carswell Air Force Base located in Fort Worth, Texas (Figure 1). This remediation program was a culmination of a United States Department of Defense (USDOD) comprehensive Installation Restoration Program (IRP) which was initiated at the site in February 1984. This remediation program was awarded to Dames & Moore on November 3, 1992 and commenced under Contract No. DACA63-93-C-0012 on January 21, 1993.

This remediation program included restoration activities at Solid Waste Management Units (SWMUs) 19, 20, and 53. Figure 2 illustrates the overall Carswell SWMU layout. SWMU 19 is the Former Fire Training Area #2 (Figure 3); SWMU 20 is the Former Waste Fuel Aboveground Storage Tank (AST) Area (Figure 3); and, SWMU 53 is the Flightline Drainage Ditch (Figure 4).

This remediation program is summarized within this Final Summary Report in accordance with USACOE Contract No. DACA63-93-C-0012, Section 01720, Subsection 1.0 through 3.2 and included the following general tasks:

- Review of previous site information;
- Work Plan preparations/Pre-Construction Meeting attendance;
- Initial soil delineation sampling;
- SWMU 19/20 demolition;
- Identified soil excavation and staging;
- Biological cleanup unit (biocell) construction;
- Staged soil transportation and loading;

- Soil excavation verification sampling;
- Biocell operation;
- Flightline drainage ditch reconstruction;
- Biocell verification sampling/demolition activities;
- Site restoration, regrading and reseeded; and,
- Final summary reporting.

The objective of this remediation program was to verify the location of site impacts, excavation and treatment aboveground by biological methods and site restoration. The following sections of this report includes a background information summary of the site, the cleanup goals for site remediation, the remedial activities undertaken at the site, associated sampling activities, and provides Dames & Moore's conclusions and recommendations.

## 2.0 BACKGROUND

The USDOD is conducting a nationwide program to evaluate waste disposal practices on DOD property, to control the migration of hazardous constituents, and to control hazards that may result from these waste disposal practices. This program, the Installation Restoration Program (IRP), consists of four phases:

- Phase I - Problem Identification/Records Search;
- Phase II - Problem Confirmation and Quantification;
- Phase III - Technology Base Development; and,
- Phase IV - Remedial Actions.

To provide some insight into the background of this site and project, Dames & Moore provides a historical summary of site information within the following subsections.

### 2.1 HISTORICAL INFORMATION

Carswell Air Force Base (CAFB) has been operational since 1942. The major industrial operations at CAFB included:

- Maintenance of aircraft and engines;
- Maintenance of aerospace ground equipment (AGE);
- Maintenance of fuel systems, weapon systems, and pneudraulic systems;
- Maintenance of general and special purpose vehicles;
- Aircraft corrosion control; and,
- Non-destructive inspection activities.

All of these activities generated various amounts of wastes such as primary oils, recoverable fuels, spent solvents, and cleaners. Practices for past and present industrial waste disposal at CAFB are summarized below:

- 1942-1970: The majority of waste oils, recovered fuels, spent solvents, and cleaners were burned at the fire department training areas during practice exercises. Some waste oils and spent solvents were disposed of through contractor removal, while some waste paints (contaminated with thinners and solvents), waste oils, and PD-680 are suspected of having been disposed of in the base landfills. Some waste oils, recovered fuels, spent solvents, and cleaners were also discharged to sanitary and storm sewers. These discharges occurred primarily at the washracks. In 1955, an oil/water separator (Facility 1190) was installed to recover waste materials discharged from the washracks. Materials from the oil/water separators were pumped out and disposed of through contractor removal. Discharge from the oil/water separator was and still is into the sanitary sewers.
- 1970-1975: During this period, most waste oils, spent solvents, and cleaners were disposed of by contractor removal. A private contractor would pump the materials from oil/water separators and from 55-gallon drums and bowers. Recovered JP-4 was still stored at the fire department training area and burned in practice exercises. Recovered JP-4 was also reused by AGE. Some waste paints (contaminated with thinners and solvents), waste oils, and PD-680 are suspected of having been disposed of in the base landfills. Some waste oils, solvents, and cleaners were discharged into sanitary drains. This primarily occurred at the washracks that discharge to the Facility 1190 oil/water separator. This oil/water separator was routinely pumped out by a private contractor, and the recovered materials removed from the base by the contractor.
- 1975-1982: The majority of waste oils, spent solvents and cleaners were disposed of by service contract either directly or through the Defense Reutilization and Marketing Office (DRMO). Recovered JP-4 was stored at the fire department training area and burned during practice exercises. Recovered JP-4 was also used by AGE. PD-680 used at the washracks was discharged to the Facility 1190 oil/water separator which discharges to the sanitary sewers.
- 1982-Present: Waste oils, solvents, and cleaners are collected in 55-gallon drums and temporarily (less than 90 days) stored at 12 hazardous waste accumulation points located throughout the flightline area. They are subsequently disposed of by contractor removal through DRMO. Recovered JP-4 fuel is stored at the fire department training area for subsequent burning in practice exercises or is reused by AGE. Removal of waste oils and PD-680 (Type II) from oil/water separators is also handled by an off-base contractor through DRMO.

## IRP PROGRAM ORIGIN

In 1976, the USDOD developed the comprehensive IRP, in response to the Resource Conservation and Recovery Act of 1976 (RCRA), and in anticipation of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, the legislation that authorizes the U.S. EPA "Superfund" program). DOD issued a Defense Environmental Quality Program Policy Memorandum (DEQPPM) dated June 1980 (DEQPPM 80-6), that required the identification of past hazardous waste disposal sites at DOD agency installations. The Air Force implemented the DEQPPM in December 1980. The program was revised by DEQPPM 81-5, dated December 1981, which reissued and amplified all previous directives and memoranda on the IRP. The Air Force implemented DEQPPM 81-5 in January of 1982. CAFB initiated Phase I of their IRP program in August 1983. CAFB completed Phase II of the IRP program in October 1988, and Phase III (Technology Base Development) was completed in April 1990.

Dames & Moore received a Request for Qualifications to conduct Phase IV Remedial Actions at CAFB in February 1992. After receipt of Dames & Moore's qualifications, Dames & Moore received a Request for Proposal/Quote to conduct the specified Remediation Program at SWMUs 19, 20, and 53. On November 3, 1992, Dames & Moore was notified that we were awarded the contract for remedial activities. On January 21, 1993, Dames & Moore received the official Notice to Proceed with the Remediation Program at CAFB SWMUs 19, 20, and 53. Appendix A contains a Chronology of Events where more specific information is available. Appendix B contains a Listing of Record Documents and the transmittal sheets of referenced documents for further specific information.

## 2.2 SITE LOCATION AND DESCRIPTION

CAFB is located on 2,751 acres of land in Tarrant County, Texas, six miles west of the center of Fort Worth and lies between the communities of White Settlement and River Oaks (Figure 1). CAFB lies within a bend of the West Fork of the Trinity River which flows along the northern and eastern boundaries of the base. The river is dammed to form Lake Worth, a drinking water supply and recreation reservoir bordering CAFB to the north. To the west, CAFB is neighbored by AF Plant 4, an Air Force-owned, General Dynamics Corporation-operated, aircraft production plant that shares the runway and several facilities with CAFB. To the south, CAFB is bordered by urban areas. Off-base facilities include the ILS Marker Beacon west of CAFB and the Weapons Storage Area (WSA), four miles west of CAFB.

Until recently, CAFB was the home of the Strategic Air Command's (SAC) 7th Bombardment Wing. As such, the mission of CAFB was to maintain the capability of strategic warfare and air refueling operations. Assigned weapon systems included the Boeing B-52 "H" model bomber and the KC-135A tanker.

As host unit, the 7th Bombardment Wing oversaw aircraft operations and maintenance agencies. In addition to maintaining bombers, tankers, and combat crews capable of strategic warfare, CAFB also housed an extensive air training effort which included the air training requirements of three tactical squadrons. The 7th combat Support Group and the USAF Regional Hospital supported the combat mission of the Wing. The total work force at CAFB (as of 1984) was approximately 5,100 military and 1,000 civilian personnel. Since that time fewer aircraft have been operational at CAFB, and downsizing due to the BRAC Program has dwindled the active number of military and civilian personnel at CAFB during recent years.

Currently, the Pentagon is planning to move the Dallas Naval Air Station to CAFB. The overall plan is to convert CAFB into a regional reserve center. This consolidation could include approximately 5,000 active duty military personnel and more than 8,000 reservists beginning the summer of 1995.

#### **PHYSICAL DESCRIPTIONS OF THE SWMUs**

SWMU 20, the Aboveground Storage Tank (AST) and its associated piping, is located adjacent to and on the southwest side of SWMU 19 (Figure 3). The capacity of this steel AST is approximately 8,500 gallons. The AST reportedly contained approximately 4,000 gallons of jet fuel (JP-4) at the time of this project. Due to the dirt mounded around this tank (greater than 10% of tank and piping volume is underground), this AST meets the regulatory requirements and descriptions of an underground storage tank (UST). Piping runs from the AST to the dumpsters located in SWMU 19.

SWMU 19 is located between the north-south taxiway and the radar facility (Figure 2) on the southwest portion of the base. SWMU 19 consists of the bermed Fire Training Area 2. The SWMU contains two bermed areas (Figure 3). The outer berm (2 feet high) is constructed of a clayey soil that is approximately 260 feet in diameter covering approximately 1.2 acres. The surface elevation is essentially flat. A drainage pipe is located on the northeast side of the outer bermed area. Drainage from the pipe is controlled by a manual valve.

The inner berm (2 feet high) is constructed of a clayey material with an approximate diameter of 120 feet covering approximately 0.25 acres. The inner bermed area contains 25-30 steel dumpsters which are arranged in the outline of an airplane. A drainage pipe is located on the northeast side of the inner berm. Drainage from the pipe is controlled by a manual valve.

SWMU 53, the Flightline Drainage Ditch, is located on the eastern portion of the base and is approximately a 600-foot long earthen drainage ditch located to the east of Haile Drive adjacent to the main aircraft washrack and Hangars 1048 and 1049 (Figure 2). The ditch is unlined from Haile Drive to its intersection with the POL Tank Farm, at which point the ditch becomes concrete lined.

Contamination was visible at SWMU 53 during the base visit (1983) in the form of a white liquid (aircraft soap) originating at the washrack and entering the ditch through a small pipe; the presence of petroleum products on the surface of the water further downstream; and the presence of a dark zone of fuel or oil saturation along the banks of the ditch at least 10 inches above the surface of the water.

In addition to normal storm drainage, this ditch receives discharges from the aircraft washracks (18 and 29) and discharges from the Fuel Systems Shop (Building 1048). Washrack wastes (PD-680, a cleaning solvent, and soap) can be discharged directly to the Facility 1190 oil/water separator, located adjacent to the Flightline Drainage Ditch, or into the drainage ditch via an overflow pipe in the drain line between the washracks and the oil/water separator. Discharge to the oil/water separator or to the drainage ditch is controlled by a valve in the drain line just upstream of the separator.

Discharges from the Fuel Systems Shop consists of JP-4 fuel drained from fuel tanks. Prior to 1978, this fuel was piped via gravity to the Facility 1190 oil/water separator. The pipe was routed through the much larger stormwater culvert that begins the Flightline Drainage Ditch. Approximately 16 years ago (1979), the pipe ruptured, and JP-4 entered the stormwater culvert and thus the ditch. The pipe was repaired in March 1984.

Associated with the remediation activities of the Flightline Drainage Ditch is the removal of a wooden trestle and four asbestos containing telephone conduits. The concrete headwall of the ditch will be removed and replaced with a new concrete headwall.

## **SWMUs OPERATION**

SWMUs 19 and 20 were operated as one unit. Jet Fuel and other fuels were stored in the AST for fire training purposes. Jet Fuel was transferred via the piping from the AST to the dumpsters inside the inner bermed area. The dumpsters were filled, and the inner bermed area was flooded intentionally with Jet Fuel. The dumpsters and inner bermed area were then ignited to simulate a burning aircraft, and fire fighting training proceeded. Sometimes the inner bermed area was overfilled, and the jet fuel flooded into the outer bermed area. At some unknown time in the past, a pit was reportedly present to collect runoff from the bermed areas. However, over time, the pit was filled with sediment and today's location of the pit is unknown.

A UST of an approximate capacity of 9,500 gallons was located at the SWMUs. The tank was removed by local contractors at an earlier date. Solvents and waste oils from the flightline shops were reportedly stored in the UST. It is possible that the waste oils and solvents from this tank have been used in the past during training exercises.

SWMU 53 collects stormwater runoff from the flightline and hangar areas. Stormwater runoff from the oil/water separator and hazardous materials storage area drains into the ditch (Figure 4). SWMU 53 also receives discharges from the washrack area and Hangar 1048 which contains the Fuel System Shop. Additional discharges from the oil/water separator unit via a 6-inch steel pipe into the SWMU occurs. Past management practices for aircraft cleaning operations usually involved the use of solvents, and it is possible the unlined ditch received solvent waste discharges from the washrack.

## **2.3 SITE SETTING AND GEOLOGY**

The following discussion of the CAFB environmental setting is derived primarily from the Installation Restoration Program Phase I Records Search Report (CH2M Hill, 1984). Information from that report is supplemented by information from initial record search literature and from the general findings of this study. The following sections describe the environmental setting of CAFB. Basic features and history of the sites investigated in this study are also discussed below.

### Geophysical Setting

CAFB is located in northeastern Texas in Tarrant County, six miles west of downtown Fort Worth. The base is bordered by Lake Worth to the north, the West Fork of the Trinity River and the community of Westworth to the east and southeast, the community of White Settlement to the south and southwest and Air Force (AF) Plant 4 to the west. One off-base facility, the Weapons Storage Area (WSA), is included in this site area. The WSA location is four miles west of CAFB on White Settlement Road.

The base lies within an area of primarily residential, recreational, and industrial/commercial land use. The principal industrial use of the area is AF Plant 4, an aircraft production plant that borders CAFB to the west and shares the runway with the base. Recreational land use includes the YMCA's Camp Carter, and various parks on the shores of Lake Worth.

### Physiography

The majority of CAFB is located within the Grand Prairie section of the Central Lowlands Physiographic Province. This area is characterized by broad terrace surfaces sloping gently eastward, interrupted by westward-facing escarpments. The land is typically grass-covered and treeless, except for isolated stands of upland timber. The northwestern part of the CAFB is within the Western Cross Timbers Physiographic Province that is characterized by rolling topography and a heavy growth of post and black-jack oaks.

### Topography

The topography of the base is fairly flat except for areas near Farmer's Branch and the Trinity River. Land surface slopes gently northeast toward Lake Worth and east toward the West Fork of the Trinity River. Elevations on base range from a high of approximately 690 feet above mean sea level (msl) at the southwest corner of the base to a low of approximately 550 feet msl at the east side of the base. The elevation of Lake Worth usually approximates the elevation of the dam spillway, 594 feet msl.

The principal drainage for CAFB is the West Fork of the Trinity River. Farmers Branch drains the southern portion of the base, but in turn discharges into the Trinity. A small portion of the north end of the base drains into Lake Worth.

### Geology - Surficial Soils

The USDA Soil Conservation Service has identified four soil associations at CAFB. The surficial soils of the installation area are primarily nearly level to gently sloping clayey soils of the Sanger-Purves-Slidell and Aledo-Bolar-Sanger Associations. In addition to the above, the clayey soil of the Frio-Trinity Association and the loamy soil of the Bastisil-Silawa Association occur on the floodplain and stream terraces of the West Fork of the Trinity River.

From youngest to oldest, the geologic units of interest at CAFB are as follows: 1) Quaternary Alluvium, 2) Cretaceous Goodland Limestone, 3) Cretaceous Walnut Formation, 4) Cretaceous Paluxy Formation, 5) Cretaceous Glen Rose Formation, and 6) Cretaceous Twin Mountains Formation.

The majority of the base is covered by alluvium deposited by the Trinity River. The alluvium is composed of gravel, sand, silt, and clay of varying thicknesses and lateral extent. The Goodland Limestone is exposed on the southern portion of the base, south of White Settlement Road. The Goodland is a chalky-white, fossiliferous limestone and marl. A small area exposing the Walnut and Paluxy Formations occurs in the northwestern corner of the base along the shores of Lake Worth. The Walnut Formation is a shell-agglomerate limestone with varying amounts of clay and shale. The Paluxy Formation is primarily a fine- to coarse-grained sand with minor amounts of clay, sandy clay, pyrite, lignite, and shale. Neither the Glen Rose Limestone, nor the Twin Mountains Formation are exposed at CAFB.

### Structure

CAFB is located on the relatively stable Texas craton, west of the faults that lie along the Ouachita Structural Belt. No major faults or fracture zones have been mapped near the base. The regional dip of the rocks beneath CAFB is between 35 and 40 feet per mile in an easterly to southeasterly direction.

## **2.4 SITE HYDROGEOLOGY AND LAND USE**

### Surface Water

CAFB is located within the Trinity River basin just south of Lake Worth, a man-made reservoir. Part of the base is drained by Farmers Branch which discharges into the West Fork of the Trinity

River just south of the Containment area. Farmers Branch begins within the community of White Settlement and flows eastward. Just south of AF Plant 4, Farmers Branch flows under the runway within two large culverts.

Most of the base surface drainage is intercepted by a series of storm drains and culverts, directed to oil/water separators and discharged to the West Fork of the Trinity River downstream of Lake Worth. A small portion of the north end of the base drains into Lake Worth.

### Groundwater

On the basis of their water-bearing properties, the geologic units at CAFB may be divided into the following five hydrogeologic units, listed from most shallow to deepest: 1) an upper perched-water zone occurring in the alluvial terrace deposits left by the Trinity River; 2) an aquitard of predominantly dry limestone of the Goodland and Walnut Formations; 3) an aquifer in the Paluxy sand; 4) an aquitard of relatively impermeable limestone in the Glen Rose Formation; and, 5) a major aquifer in the sandstone of the Twin Mountains Formation. Each of these units is examined in more detail below.

### Upper Zone

Groundwater occurs within the coarse sand and gravels deposited by the Trinity River, but these deposits are usually limited in areal extent and isolated by surrounding low-permeability clays and silts. Recharge to the water-bearing deposits is local, from rainfall and infiltration from stream channels and drainage ditches. Water flow in the alluvium is basically eastward, toward the West Fork of the Trinity River.

In parts of Tarrant County, generally close to the Trinity River, water in the alluvium is developed for irrigation and residential use. The community of River Oaks, immediately east of CAFB, had supply wells that developed water from the alluvial deposits at a location near the USAF Hospital. The wells were abandoned when CAFB purchased the property for hospital construction. For the most part, groundwater is not economical to develop from the alluvium due to the water's limited distribution and susceptibility to surface/stormwater pollution.

### Goodland/Walnut Aquitard

The perched water present in the alluvium is separated from the aquifers below by the low permeability limestones and shales of the Goodland Limestone and Walnut Formation. The

aquitard is composed of moist clay and shale layers interbedded with dry limestone beds. Though primarily dry, drillers in the area report that small amounts of water enter the borehole while drilling through the Walnut Formation, suggesting that groundwater may move through the Walnut along bedding planes (Hargis and Associates, Inc., 1984). The thickness of the Goodland/Walnut aquitard is approximately 25 feet or greater beneath most of CAFB. However, the top of the aquitard is an erosional surface and weathering may have reduced the thickness of the limestone in isolated areas. It is also reported that the upper zone and Paluxy Formation are in contact at the eastern boundary of AF Plant 4, where both the Goodland and Walnut Formations have been removed by erosion (Hargis and Associates, 1985). In areas of similarly extensive erosion, water in the upper zone would come in contact with water in the Paluxy aquifer.

#### Paluxy Aquifer

The Paluxy aquifer is the most shallow aquifer occurring beneath CAFB. In the base area, water in the Paluxy would naturally occur under confined conditions beneath the Goodland/Walnut aquitard (except where the aquitard is missing due to erosion, as discussed above). However, extensive pumping in the Fort Worth area has lowered the Paluxy potentiometric surface below the top of the formation, resulting in unconfined conditions beneath the base. The Paluxy Formation is divided into upper and lower sand members and the aquifer is likewise divided into upper and lower aquifers. The upper sand is fine-grained and shaley and the lower sand is coarser; therefore, most wells are completed in the lower section.

The Paluxy aquifer is an important source of potable groundwater in the Fort Worth area. Communities surrounding CAFB, especially White Settlement, develop municipal water supplies from the Paluxy, as well as from the deeper Twin Mountains aquifer. As a result of its extensive use as a water supply, water levels in the Paluxy aquifer have declined significantly over the years. Water levels in the immediate CAFB vicinity have not decreased as much as in the Fort Worth area in general because of the proximity of the Lake Worth recharge area and because the base does not develop water from the Paluxy. Water quality in the Paluxy aquifer is generally good and is satisfactory for potable use.

#### Glen Rose Aquitard

Below the Paluxy aquifer are the fine-grained limestone, shale, marl, and sandstone beds of the Glen Rose Formation. The thickness of the formation varies from 250 to 450 feet. Though the sands in the Glen Rose Formation yield small supplies to wells in Fort Worth and western

Tarrant County, the relatively impermeable limestone is an aquitard restricting water movement between the Paluxy aquifer above and the Twin Mountains aquifer below.

#### Twin Mountains Aquifer

The Twin Mountains Formation is the oldest formation used for water supply in the CAFB area. The formation consists of a basal conglomerate of chert and quartz, grading upward into coarse- to fine-grained sand interbedded with shale. The thickness of the formation varies between 250 and 430 feet.

Recharge to the Twin Mountains aquifer occurs west of CAFB, where the formation crops out. Water movement is eastward in the downdip direction. Like water in the Paluxy aquifer, Twin Mountains water occurs under water-table conditions in the recharge area and becomes confined as it moves downdip. The Twin Mountains aquifer is the principal aquifer in Tarrant County. The formation yields large water supplies for municipal and industrial purposes.

Groundwater withdrawals from the Twin Mountains aquifer, primarily for municipal water supply, have resulted in declining water levels. Between 1955 and 1976, the potentiometric surface of the aquifer dropped approximately 250 feet. Water quality in the Twin Mountains aquifer is suitable for potable use throughout the Fort Worth area. Water in the upper sands of Fort Worth may be too mineralized for human consumption.

#### Land Use

The base is surrounded by residential, commercial, recreational, and industrial land. Residential land use is to the southwest, southeast, and east of the base. Commercial property is south and recreational (Lake Worth) is north of the base. AF Plant 4 is the industrial facility directly west of CAFB.

## **2.5 RESULTS OF PREVIOUS SITE INVESTIGATIONS**

Initial site investigations were conducted at SWMUs 19, 20, and 53 by Radian Corporation as documented in their reports dated April 1990 (Radian, 1990 - Phase III Reports). Dames & Moore acquired these reports from the USACOE after contract commencement and did not have the benefit of this data prior to project award.

During these preliminary site investigations, 5 groundwater monitor wells and 5 separate borings were installed in the area of SWMUs 19 and 20 (the Former Fire Training Area 2). These wells were completed in the upper zone aquifer, and the borings were installed to depths of up to 25 feet below ground surface (bgs) and sampled at various depths. Collected analytical data indicated soil and groundwater impacts by heavy metals (EPA Test Method 7000), Total Petroleum Hydrocarbons, (TPH-EPA Test Method 418.1), Volatile Organic Compounds (VOCs-EPA Test Method 8240), and Semivolatile Organic Compounds (SVOCs-EPA Test Method 8270). The boring soil samples were collected within the outer berm area of SWMU 19. TPH concentrations within site soils ranged from below detection limits (BDL) to 5,760 parts per million (ppm). Benzene, Toluene, Ethylbenzene and Xylene (BTEX) concentrations within site soils ranged from BDL to 47.47 ppm. Total SVOC concentrations within site soils ranged from BDL to 17.3 ppm. Previous analytical data have been tabulated and summarized on Table 1. Dames & Moore's contract included only soil remediation within SWMUs 19, 20, and 53; therefore, previous groundwater data are not summarized or included in this report.

During initial investigations at CAFB by Radian within SWMU 53, the Flightline Drainage Ditch, 5 surface and subsurface soil samples were collected for purposes of site screening at 5 equally spaced locations along the ditch. These surface soil samples were collected from the surface and 0.1 feet bgs. Collected analytical data indicated soil impacts by heavy metals, TPH, VOCs and SVOCs. TPH concentrations ranged from 34 ppm to 3,500 ppm. BTEX concentrations ranged from 0.034 ppm to 4.82 ppm. Total SVOC concentrations ranged from 1.11 ppm to 88.3 ppm within site soils. Based upon these investigations, CAFB elicited cost proposals to conduct a decommissioning/remediation program at SWMUs 19, 20, and 53 by Bioremediation. Dames & Moore was notified on November 3, 1992, that we had been selected to implement this program. Dames & Moore then developed a scope of work based on USACOE-supplied Contract No. DACA6393C0012 documents which is discussed in the following section.

### 3.0 SCOPE OF WORK

Dames & Moore received the Notice To Proceed from the USACOE on January 21, 1993 and attended a Pre-Construction Meeting at CAFB on January 26, 1993, to discuss CAFB rules, policies, and requirements in order to implement the requested Scope of Work.

Dames & Moore performed the following activities before performing the scope of work outlined in the Request for Proposal (RFP):

- Attended the Pre-Construction Meeting at CAFB;
- Prepared all the necessary Work Plans to be approved prior to the start of field work;
- Obtained security passes for contractor and subcontractor personnel for site access;
- Mobilized office trailer to the trailer site;
- Mobilized the equipment to be used during the project to the job site;
- Held kickoff Site Safety Meeting with Contractor and Subcontractor personnel;
- Build the decontamination areas at each SWMU area;
- Set up personnel decontamination facilities; and,
- Designed the Bioremediation Cleanup Unit or Biocell for the site specified by USACOE/CAFB personnel.

For SWMU 20 (AST area), the order of the scope of work included the following:

- Analyzed the liquid contents of the AST for determination of a proper disposal facility;
- Removed the tank contents by use of a vacuum truck and disposed of the contents at an appropriately-licensed disposal facility;
- Purged the AST and its associated piping to prepare them for removal;
- Removed the concrete pad and its associated piping, and hauled to appropriate disposal facility;

- Decommissioned the AST and its associated piping and hauled to an appropriately-licensed disposal facility for destruction;
- Per characterization soil sampling around the AST as detailed in the RFP to evaluate appropriate soil volume to remove. A maximum of 3 feet below ground surface was to be removed;
- Excavated the appropriate soil amount as identified by the characterization sampling, and hauled to the Biocell for remediation as detailed in the RFP;
- Performed verification sampling around the former site of the AST to confirm reaching the USACOE prescribed excavation depth;
- Upon receiving verification sampling results and approval from USACOE to backfill the excavation areas, Dames & Moore placed clean clay for a liner, backfilled SWMU 20 with treated soils, and graded the site to conform with the surrounding area; and,
- Placed topsoil and reseeded the soil with grass.

For SWMU 19, the order of the scope of work included the following:

- Analyzed the liquid contents of the dumpsters to identify the proper disposal facility;
- Removed the liquid contents by use of a vacuum truck and transported liquids to the appropriately-licensed disposal facility;
- Decontaminated the dumpsters by rinsing according to RFP specifications and transported them to the appropriately-licensed disposal facility for destruction;
- Removed, decontaminated and disposed of the 10 foot diameter steel ring;
- Removed and disposed of outlet pipes and valves;
- Performed characterization sampling as detailed in the RFP to identify the appropriate volume of soil to remove. A maximum of 3 feet below ground surface was to be removed;
- Excavated the soil and hauled to the Biocell for remediation as detailed in the RFP;
- Performed verification sampling as detailed in the RFP throughout the site to confirm reaching the USACOE prescribed excavation depth;

- Upon receiving verification sampling results, placed clean clay liner, backfilled SWMU 19 with treated soils, and graded the site to conform with the surrounding area; and,
- Placed an appropriate amount of topsoil and reseeded the soil with grass.

For SWMU 53, the order of the scope of work included the following:

- Performed the characterization sampling as detailed in the RFP;
- Removed the asbestos telephone pipe as detailed in the RFP;
- Transported the asbestos pipe as detailed in the RFP to the appropriately-licenses disposal facility;
- Demolished the headwall and concrete rubble with a backhoe equipped with demo hammer;
- Removed and transported the rubble to an appropriately-licensed disposal facility;
- Removed the 3 foot wide concrete footing at the entrance to the POL Facility;
- Excavated the appropriate volume of soils as specified by the USACOE in order to lay the new Flightline Drainage Ditch;
- Stockpiled the excavated soil in designated area (adjacent parking lot) on top of 20 mil plastic, surrounded by berms and covered with 6 mil plastic for future characterization and proper disposal by USACOE;
- Regraded the channel walls and floor;
- Installed the 66" reinforced concrete pipe (RCP);
- Placed and compacted the backfill materials;
- Installed the new concrete headwall;
- Installed new drain lines and manhole;
- Installed the 6-inch collector pipe;
- Installed Concrete Slope Paving;
- Performed final grading and reseeded barren backfill as necessary;

- Survey the final results;
- Create final As-Built drawings; and,
- Prepared Summary Report.

#### 4.0 CLEANUP GOALS

Based on negotiations that CAFB and USACOE held with the Texas Natural Resources Conservation Commission [TNRCC - then the Texas Water Commission (TWC)], the RFP indicated that the cleanup goals to be achieved in the excavated areas would be 100 ppm TPH and 30 ppm total BTEX. Likewise, the treatment goals for the remediated soils were to be 100 ppm TPH and 30 ppm total BTEX.

Within the contract documents, it was made clear that the USACOE had the option to deviate from these cleanup goals if attainment was deemed unrealistic.

## 5.0 WORK PLAN PREPARATION

Based on the requirements contained within the RFP and Contract Documents, Dames & Moore was required to prepare Work Plans for conducting the remediation job at CAFB and have them approved by the USACOE prior to the commencement of any field work.

Therefore, Dames & Moore prepared the required Work Plans, and on February 5, 1993, the following Draft Work Plans were submitted to the USACOE for review and approval:

- Site Health and Safety Plan (SHSP);
  - Accident Prevention Plan (APR);
  - Emergency Response Plan (ERP);
- General Site Work Plan (GSWP);
- Asbestos Removal and Disposal Plan (ARDP);
- Materials Handling Plan (MHP);
  - Spill Control and Discharge Plan (SCDP);
- Contractor Quality Control Plan (CQCP);
- Environmental Protection Plan (EPP); and,
- Quality Control Sampling Plan (QCSP).

On April 5, 1993, USACOE notified Dames & Moore (Appendix A and B) that the final modifications to the final Work Plan (CQCP) had been accepted, and all the Work Plans were approved for implementation.

## 6.0 REMEDIAL ACTIONS

Once the Work Plans were approved by the USACOE, Dames & Moore obtained the appropriate passes and CAFB training for employees and subcontractors to be involved in remedial activities. Once in hand Dames & Moore's team was able to mobilize to the site to set up the necessary logistical site facilities to enable smooth field work progression. While setting up the temporary field trailer, equipment trailer, decontamination areas, power and phones, Dames & Moore mobilized to the SWMUs to collect the initial delineation samples.

### 6.1 INITIAL SOIL DELINEATION SAMPLING

After receiving the approval from USACOE to commence initial soil delineation sampling at SWMUs 19, 20, and 53, Dames & Moore mobilized to SWMUs 19 and 20 on March 24, 1993. In accordance with the contract documents, Dames & Moore collected initial delineation soil samples at nine locations within SWMU 19. In all Dames & Moore collected 30 soil samples at SWMU 19 comprised of nine locations at three depths (DFT-1 through DFT-30 at 0.5, 1.5 and 2.5 bgs) and three duplicates (D-3, D-12, and D-24). A surface water sample (WFT-1) was also collected at SWMU 19. All samples were analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020). Figure 5 indicates these sample locations. Table 2 summarizes the analytical data which was forwarded to the USACOE on March 30, 1993. TPH concentrations in soil ranged from BDL to 13,000 ppm. BTEX concentrations in soil ranged from BDL to 25.5 ppm. The surface water contained TPH concentrations of 1.1 ppm, and BTEX concentrations were BDL. Analytical data sheets and associated Chain-of-Custody documentation are provided in Appendix C. Laboratory analyses were conducted by NDRC/Inchcape Laboratory Services, a MRD/USACOE-approved laboratory.

Dames & Moore collected one delineation soil sample at SWMU 20 (AST Area) at a 0.5 foot bgs depth on March 24, 1993 (AST-1). Two additional delineation soil samples were collected at a 0.5 foot bgs depth on April 26, 1993, after the AST had been removed. Table 2 summarizes this data, and Figure 5 shows these sample collection locations. TPH concentrations in these soil samples ranged from 2,800 ppm to 6,100 ppm. BTEX concentrations in all these soil samples were BDL. Analytical data sheets and Chain-of-Custody documentation are provided in Appendix C.

On March 25, 1993, Dames & Moore mobilized to the Flightline Drainage Ditch, SWMU 53, to collect initial delineation samples. Soil samples were collected along the drainage ditch in accordance with contract requirements at 0.5 and 1.5 feet bgs at six locations (DFLD-1 through DFLD-12). One surface water sample was also collected (WFLD-1). All samples were analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020). Sample DFLD-2 was attempted to be collected at 1.5 bgs at the first sample location at the top of the ditch, but was unable to be collected due to auger refusal. A duplicate soil sample was collected from DFLD-3. Figure 6 indicates these sample locations, and Table 2 summarizes the analytical data. TPH concentrations within SWMU 53 sampled soils ranged from BDL to 120 ppm. BTEX concentrations ranged from BDL to 14.8 parts per billion (ppb). The surface water sample collected in the drainage ditch exhibited BDL concentrations for both TPH and BTEX. On June 9, 1993, Dames & Moore collected another delineation sample (FLD-7) along the drainage ditch which exhibited 76 ppm TPH and 5.9 ppb BTEX. Analytical data sheets and Chain-of-Custody documentation are provided in Appendix C. All preliminary delineation data was submitted to the USACOE on March 30, 1993.

## 6.2 ASBESTOS CEMENT PIPING REMOVAL/DEMOLITION ACTIVITIES

On April 8, 1993, Dames & Moore and subcontractors (West, Inc. of Dallas, Texas and TASCO of Rowlett, Texas) mobilized to SWMU 53, Flightline Drainage Ditch and began work to remove the asbestos-containing transite piping (transite). Associated with the remediation of SWMU 53 were four asbestos cement (transite) pipes. The pipes were approximately 160 linear feet in length and, at one time, held telephone conduits.

West, Inc. conducted air monitoring during the removal process in accordance with contract specifications, and TASCO conducted the asbestos containing material removal in accordance with State of Texas Department of Health (TDH) protocols and contract requirements.

The transite was removed by first wetting the material, double-wrapping the pipes in polyethylene plastic, and then un-coupling each pipe at the joint. The abatement workers utilized wet removal methods, dual cartridge half-face respirators, and double-suit full-body protection. The asbestos-containing material (ACM) was wrapped in two layers of 6 mil polyethylene plastic, properly marked with the owner and contractor identification information, and loaded into a poly-lined vehicle for transportation. Following removal of the transite, measurement of the total linear footage was performed and consisted of a total of 167 linear feet. A copy of the manifest signed by CAFB and provided by TASCO is presented in Appendix D.

Air samples collected during the project were analyzed and found to contain airborne fiber concentrations at levels less than the recommended limits for the respiratory protection equipment exposure ratings. Personnel samples collected and analyzed exhibited levels less than the recommended limits for the eight (8) hour time-weighted averages for the respiratory protection equipment exposure ratings. Upon completion of the abatement, work area and environment samples (upwind and downwind) for the work area were analyzed and were found to be less than 0.010 fibers per cubic centimeter (f/cc) of air, which is below the acceptable EPA industry standard level for clean air of 0.01 f/cc. All samples were analyzed utilizing Phase Contrast Microscopy (PCM) in conformance with the National Institute of Industrial and Occupational Health (NIOSH) 7400 method (see Appendix D for copy of report).

On April 20, 1993, Dames & Moore mobilized to SWMUs 19 and 20 and commenced demolition activities. On April 21, 1993, the 8,500 gallon waste fuel AST was emptied of 3,054 gallons of waste fuel, properly evacuated, triple rinsed, marked and shipped off-site for destruction. The fuel was transported off-site for recycling/disposal by Mobley Company of Corsicana, Texas. The tank was decommissioned at Texas Tank Destroyal in Venus, Texas. On April 26, 1993, the 25 steel dumpsters were also transported and decommissioned at the Texas Tank Destroyal yard in Venus, Texas. The associated rubble, debris, fire ring and associated underground piping was transported and disposed at CSC Landfill in Avalon, Texas. Associated tank/dumpster destruction certificates, waste fuel manifest, and piping/debris manifest are provided in Appendix D.

### 6.3 BIOCELL CONSTRUCTION

Prior to construction of the Biocell, the USACOE moved the location of the Biocell to the southeast corner of the south ramp of the CAFB airfield. The Biocell was to be situated just north of Building 1050 and just south of Hangar 1041. Dames & Moore used the provided dimensions to design the configuration and assemble the Biocell. On April 26, 1993, a 60 mil HDPE liner was delivered to CAFB for use in constructing the Biocell. On April 29, 1993, the geotextile fabric to go under the liner arrived at CAFB. On May 5, 1993, Dames & Moore collected two samples (BS-1 and BS-2) of the borrow source for the clay to be utilized in the construction of the Biocell berms. The analytical data exhibited TPH concentrations of 12 ppm (BS-1) and < 10 ppm (BS-2), and the analytical data sheets and Chain-of-Custody documentations is provided in Appendix E. The borrow source was approved for use by the USACOE.

Dames & Moore's design of the Biocell and its associated sprinkler system is exhibited on Figure 7. The 60 mil HDPE liner for the Biocell was constructed on the concrete ramp and overlaid with the geotextile fabric to preserve the integrity of the 60 mil HDPE liner which was overlaid by 3 to 6 inches of hay (drainage/visual discing layer). The impacted soil to be treated in the Biocell was then laid on top of the hay in an 18 inch lift. The Biocell was then surrounded by 4 feet high and 4 feet wide clay berms which anchor the fabric and liner to contain runoff, and deflect runoff. The impacted soils were surrounded within the bermed area by a 4 feet wide drainage path which led to a sump at the downgradient end of the Biocell. The sump was used to collect runoff to keep the soils from becoming too moist for microbial hydrocarbon degradation activities. A sprinkler system was constructed across the middle of the Biocell with two separate lines with 3 sprinkler heads per line in order to reach all areas of the Biocell. By May 17, 1993, the Biocell was completely constructed and ready to accept soils for bioremediation activities.

#### 6.4 SOIL EXCAVATION AND BIOCELL LOADING

On May 20, 1993, once the Biocell was constructed, Dames & Moore commenced the excavation of identified soils at SWMUs 19 and 20. Based upon the initial delineation sampling and visual evaluation of subsurface soils at the Former Fire Training Area, the USACOE gave Dames & Moore the direction to continue excavating below the two foot depth to three feet bgs in SWMUs 19 and 20.

From May 20 to June 8, 1993, a total of 690 full tandem dump truck loads of impacted soils were excavated, hauled and placed into the Biocell for treatment. Documentation of these transported loads of soils are provided on trip tickets in Appendix D.

On June 7, 1993, Dames & Moore moved over to SWMU 53, the Flightline Drainage Ditch, to excavate the impacted soils to add them to the Biocell. Once the headwall of the old drainage ditch was removed, Dames & Moore encountered red and black waste materials. The USACOE directed Dames & Moore to place booms in a nearby creek and to excavate and stockpile the red/black waste materials and impacted soils of SWMU 53. The soils were to be stockpiled on a 20 mil liner, surrounded by a clay berm and covered with 6 mil liner until a decision was made on how to dispose of it. These soils, due to the nature of the waste materials, would not be added to the Biocell for remediation. In total 668 cubic yards of impacted soils were surveyed and stockpiled in the parking lot adjacent to SWMU 53.

## 6.5 SOIL EXCAVATION VERIFICATION SAMPLING

Once the soils were excavated, transported and loaded into the Biocell from SWMUs 19 and 20, the USACOE gave the approval to collect the excavation verification samples. On June 9, 1993, Dames & Moore collected the verification samples in accordance with the contract requirements. A total of five soil samples (VFT-28 through VFT-32) were collected within the excavation area of SWMU 19, Former Fire Training Area. Figure 8 indicates the locations of these samples. These 5 soil samples were collected at a depth of 3.5 feet below original surface grade. Sample VFT-32 was collected and split from VFT-31 to form a duplicate sample. TNRCC representatives were present to view our verification sampling procedures and to collect split samples for their own analyses. TPH concentrations ranged from BDL to 6,400 ppm, and BTEX concentrations ranged from BDL to 74.3 ppm. A summary of these analytical data is provided on Table 3. Analytical data sheets and Chain-of-Custody documentation is provided in Appendix F.

Dames & Moore also collected a total of two excavation verification soil samples (VAST-4 and VAST-5) per contract terms from SWMU 20 - AST Area (Figure 8). These two soil samples were collected at a depth of 3.5 feet below original surface grade. TPH concentrations ranged from 38 ppm to 3,900 ppm, and BTEX concentrations ranged from BDL to 1.83 ppm. These data are summarized on Table 3, and the analytical data sheets and Chain-of-Custody documentation is provided in Appendix F.

Based on a review of these data, it was evident that one half of the verification samples exceeded the cleanup goals of 100 ppm TPH and 30 ppm BTEX. After these analyses were reviewed by the USACOE, they negotiated with the TNRCC concerning the remaining soil levels. On July 27, 1993, the USACOE sent Dames & Moore a letter releasing us from the requirement of further excavation in SWMUs 19 and 20. The USACOE stated that they had the option to complete the remediation program without attaining the cleanup goals or site closure due to on-going work at the base (Appendix A and B).

Dames & Moore was notified in writing on June 29, 1993, that we were released from the requirement of biotreating the waste-impacted, stockpiled soils at SWMU 53. This letter also released Dames & Moore from the contract requirement to collect any excavation verification soil samples from SWMU 53 (Appendix A and B).

In addition, Dames & Moore was notified to cover the bottom of the excavations of SWMUs 19 and 20 with an impermeable clay liner to create a barrier between deeper impacted soils and

future backfill soils. Dames & Moore was also put on notice to stop work at SWMU 53 until decisions could be made, and the USACOE directed Dames & Moore to proceed with Biocell operations.

## 6.6 BIOCELL OPERATIONS

Once the impacted soils had been loaded in the Biocell (8,894 cubic yards in all), on July 14, 1993, Dames & Moore collected initial Biocell background soil samples. These baseline soil samples were collected from 10 grids within the biocell (Figure 9). The samples (BCUBGS-1 through BCUBGS-13) were composited from a 5-star grid within each of 10 grids and analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020) along with selected nutrient levels. Along with these 10 samples, a duplicate (Grid 7) sample, a rinsate sample and a USACOE split sample were collected (this also occurred with all 5 of the Biocell progress sampling events). TPH concentrations ranged from 530 ppm to 1,200 ppm with an average value of 857 ppm. Total BTEX concentrations ranged from BDL to 25.3 ppb. A summary of the periodic progress sampling of the Biocell is provided on Table 4. Analytical data sheets and Chain-of-Custody documentation are provided in Appendix G.

On August 2, 1993, Dames & Moore spread 2 tons (80 bags) of fertilizer (20-30-0) on the Biocell to stimulate biological growth and hydrocarbon degradation. Dames & Moore monitored the moisture content of the soils and watered the Biocell, as necessary, to keep an optimum water content throughout the Biocell operation process. On August 16, 1993, Dames & Moore conducted the first periodic Biocell progress sampling to compare to the baseline samples collected in July, 1993. Once again, the 10 grids were composite sampled (BCU-14 to BCU-26). TPH concentrations ranged from 210 ppm to 710 ppm (Figure 9). All BTEX levels were BDL. The average TPH concentration had dropped to 470 ppm (Table 4). Analytical data sheets and Chain-of-Custody documentation are provided in Appendix G.

On September 17, 1993, Dames & Moore collected the 2nd Biocell progress samples from the 10 grids (BCU-27 to BCU-39). TPH concentrations ranged from 130 ppm to 330 ppm (Figure 9), and BTEX concentrations were all BDL (Table 4). The average TPH concentrations had dropped to 211 ppm (Appendix G).

On September 29, 1993, Dames & Moore spread 500 pounds (10 bags) of fertilizer (20-20-2) on the Biocell to further promote microbial growth and hydrocarbon degradation. On October 18, 1993, Dames & Moore conducted the 3rd Biocell progress sampling of the 10 grids (BCU-40

to BCU-52). TPH concentrations ranged from 36 ppm to 125 ppm, and BTEX concentrations again were all BDL (Table 4). The average TPH concentration had dropped to 64 ppm (Figure 9). All grids but two (#4 and #9) were below the TPH cleanup goal of 100 ppm (Appendix G). On October 25, 1993, Dames & Moore spread another 100 pounds of fertilizer (20-20-2) to promote the final degradation step.

On November 16, 1993, Dames & Moore collected two more (Grids #4 and #9) periodic Biocell progress soil samples (BCU-53 and BCU-54). TPH concentrations were 90 ppm and 186 ppm (Appendix G), respectively, with BTEX remaining BDL (Table 4). The average TPH concentration for these two grids was 138 ppm (Figure 9). Based upon the last two sampling events, Dames & Moore notified the USACOE that final Biocell verification sampling could take place within a month's time and approval was granted.

## 6.7 FLIGHTLINE DRAINAGE DITCH CONSTRUCTION

As a recap, in June, 1993, Dames & Moore removed the headwall of the Flightline Drainage Ditch (SWMU 53) and rebuilt the CAFB water pump. During these demolition activities, Dames & Moore encountered red and black wastes which necessitated the USACOE to release Dames & Moore from the obligation to bioremediate these soils or to collect verification samples at SWMU 53. Then on June 25, 1993, the USACOE suspended work at SWMU 53.

On July 29, 1993, the USACOE lifted the suspension of work at SWMU 53 and directed Dames & Moore to only excavate enough soil to allow the installation of the new concrete drainage system. The USACOE instructed Dames & Moore to cut one foot more off the sides of the old ditch to the grass from stations 0+00 to 1+00 and from 4+50 to the end of the old ditch. Dames & Moore was to stockpile the excavated impacted soils in the adjacent parking lot on 20 mil plastic surrounded by berms and covered by 6 mil plastic until the USACOE characterized the material. The USACOE sampled the waste and arranged for the transportation and disposal of the 668 surveyed cubic yards of soil.

During August 1993, Dames & Moore continued to remove and stockpile concrete and rubble from the old drainage ditch area of SWMU 53. On August 30, 1993, Dames & Moore plugged "Line A" at SWMU 53. On August 31 and September 1, 1993, Dames & Moore transported and disposed 12 loads (240 cubic yards) of concrete rubble from SWMU 53 at Laidlaw Landfill in Fort Worth. Corresponding manifests for this material are provided in Appendix D. On September 15, 1993, Dames & Moore received the 66 inch reinforced concrete pipe (RCP) for

the new SWMU 53 drainage ditch and began installation. Dames & Moore hauled in clay from the approved borrow source to backfill around the RCP.

On October 6, 1993, Dames & Moore formed the new headwall and bottom slab of the drainage system in accordance with the contract requirements. The manhole area for Haile Drive was excavated and fabricated. SWMU 53 was now ready for final backfill and reseeding.

## 6.8 BIOCELL VERIFICATION SAMPLING AND DISMANTLEMENT ACTIVITIES

On November 30 and December 1, 1993, Dames & Moore conducted the final Biocell verification sampling in accordance with contract specifications as scheduled with the USACOE, CAFB and TNRCC personnel. Figure 10 indicates the grid spacing and final Biocell verification soil sample locations. In total, 113 grid samples were collected and analyzed for TPH (EPA Test Method 418.1) and BTEX (EPA Test Method 8020). All BTEX concentrations were BDL; however, the TPH values all raised considerably and none of the grids met the cleanup goal of 100 ppm TPH (Table 5). This analytical data and Chain-of-Custody documentation are provided in Appendix G.

Dames & Moore, on our own behalf, conducted an evaluation of this phenomena since the past sampling a month before had indicated that all but one grid (#9) was treated to below the 100 ppm TPH cleanup goal. The unexpected results were investigated and found to be confirmed. Dames & Moore concluded that the TPH could have elevated due to decreased microbial action with decreased temperatures which contributed to the TPH levels in soils from the broken down biomass. The biomass is the non-polar lipid soluble material comprising the cell wall matrix of the bacteria cultured in the soils over the course of the treatment process. Therefore, Dames & Moore chose seven of the highest TPH (by EPA Test Method 418.1) sample grids and analyzed collected samples for Extractable TPH by EPA Test Method 8000. EPA Test Method 8000 targets fuel source contamination instead of total organic content like EPA Test Method 418.1. All results were well below the 100 ppm TPH cleanup goal (Table 5 - Figure 10 - Appendix G).

On March 14, 1994, the USACOE sent Dames & Moore a letter stating that they, CAFB and TNRCC had come to an agreement concerning the treated soil levels, approved the bioremediation and directed the backfill of the treated soils into SWMUs 19 and 20 excavation areas and dismantling the Biocell (Appendix B).

On June 13, 1994, Dames & Moore commenced with the removal of the Biocell soils to backfill the excavated areas of SWMUs 19 and 20 with the approval of the USACOE, CAFB and the TNRCC. By June 28, 1994, Dames & Moore had hauled 647 loads of treated soils and 198 loads of clay from the Biocell berms to SWMUs 19 and 20. Dames & Moore sampled the water collected in the Biocell (BC-1) which indicated a TPH concentration of 0.5 ppm and BTEX of BDL. Dames & Moore also sampled the water pooled on the liner (LW-1) which indicated a TPH and BTEX concentration of BDL (Table 3 - Appendix E). Dames & Moore transported and disposed of 8 loads of cut up liner and geotextile fabric at the Laidlaw Landfill in Fort Worth. Manifests documenting the disposal of this material are presented in Appendix D.

Graham Associates, Inc. surveyed the backfilled material in SWMUs 19 and 20 (no clay, only treated soils were included in this survey volume) for payment. After negotiations, the USACOE accepted and approved for payment a volume of 9,562 cubic yards of soil excavated, hauled and stockpiled and 8,894 cubic yards of soil remediated, backfilled and compacted (Appendix B).

## 6.9 SITE RESTORATION, REGRADING AND RESEEDING

After Dames & Moore, USACOE and CAFB representatives conducted the Pre-Final Inspection, Dames & Moore was approved for site restoration completion activities to include regrading, general site cleanup, reseeded, final surveying, and final As-Built Drawings transmittal.

Dames & Moore mobilized to SWMU 53 and prepared the subsurface and top soil, and returving in accordance with contract specifications. Dames & Moore mobilized to SWMUs 19 and 20 (after the payment survey of treated soils was conducted) and restored, compacted and regraded that site prior to returving. On August 3, 1994, Dames & Moore met USACOE and CAFB representatives at the site to have the Final Site Inspection. Dames & Moore passed the inspection with some general site cleanup work. Dames & Moore conducted the general site cleanup activities, turned over the Biocell sprinkler system to CAFB personnel, and demobilized equipment and personnel from the job. The last day Dames & Moore was physically on the site was August 17, 1994.

The two sites (SWMU 19/20 and SWMU 53) were then final surveyed after a stand of grass appeared, and the final As-Built Drawings were developed and submitted to the USACOE (Figures 11 and 12). The USACOE accepted the Final As-Built on November 21, 1994.

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the project as described herein, Dames & Moore presents the following conclusions:

- Due to the collected verification samples at SWMUs 19 and 20 and the waste materials left behind at SWMU 53, the remediation project did not achieve clean closure;
- Soils remain at both areas above the cleanup goals prescribed for this site;
- Based on past analytical data, it appears that deeper impacts exist at the site which may have adversely impacted shallow groundwater quality;
- Based on the objectives and directives presented to Dames & Moore and approved by USACOE, CAFB and TNRCC, the bioremediation program was a success compared to the contractual requirements; and,
- With the submittal of this Final Summary Report, Dames & Moore has successfully met all of the contractual requirements for Contract No. DACA63-93-C-0012.

Based on these conclusions, Dames & Moore presents the following recommendations:

- This Final Summary Report should be copied and submitted by the USACOE to the TNRCC;
- The USACOE should use the available data for site soils and groundwater to prepare a health-based risk assessment identifying possible exposure pathways and receptors in order to arrive at reasonable cleanup objectives;
- Based on these cleanup objectives, negotiate with the regulators for a more passive, longer-term and cost effective cleanup method(s) for site closure; and,
- The USACOE should provide Dames & Moore with a letter of completion for this contract with an associated highly successful rating.

## REFERENCES

- CH2M Hill, 1984, "Installation Restoration Program Phase I Records Search Report".
- Dames & Moore, Inc., February, 1993, "Work Plans, Carswell Air Force Base, Fort Worth, Texas, for US Army Corps of Engineers, Fort Worth District".
- Radian Corporation, January, 1988, "Installation Restoration Program, Phase II - Confirmation/Quantification, Stage 2, Carswell Air Force Base, Work Plan".
- Radian Corporation, January, 1988, "Installation Restoration Program, Phase II - Confirmation/Quantification, Stage 2, Carswell Air Force Base, Quality Assurance Project Plan".
- Radian Corporation, April, 1990, "US Air Force Installation Restoration Program, Remedial Investigation/Feasibility Study - Site 12, Carswell AFB, Texas, Decision Paper".
- Radian Corporation, April, 1990, "US Air Force Installation Restoration Program, Remedial Investigation/Feasibility Study - Site 13, Carswell AFB, Texas, Decision Paper".
- Radian Corporation, May 1991, "Carswell Air Force Base, Texas, RCRA Permit, Part B, Number HW50289, Volume 1, RFI Work Plans".
- Radian Corporation, October, 1991, "Carswell Air Force Base, Fort Worth, Texas, Specifications for Remediation of Solid Waste Management Units (SWMU) 19, 20 and 53", Volumes I, II and III.

# TAB

TABLES

TABLES

TABLE 1												
PREVIOUS SOIL SAMPLING ANALYTICAL DATA SUMMARY												
SWMUs 19, 20, AND 53												
CARSWELL AIR FORCE BASE												
FORT WORTH, TEXAS												
FOR												
U.S. ARMY CORPS OF ENGINEERS												
AREA	BORING	DEPTH BGS (FT)	DATE	TPH (mg/kg) <sup>3</sup>	VOLATILE ORGANICS (mg/kg)					TOTAL BTEX	METHYLENE CHLORIDE	SEMI VOLATILE ORGANICS (mg/kg)
					BENZENE	TOLUENE	ETHYL BENZENE	XYLENE				
FTA2 <sup>1,2</sup>	12G	14-17	2-20-88	ND <sup>4</sup>	ND	0.19	ND	ND	0.19	ND	ND	ND
FTA2	12H-1	0-4	2-23-88	3,230	0.37	11.0	4.1	32	47.47	ND	ND	17.3
FTA2	12H-2	4-9	2-23-88	2,110	ND	8.8	4.8	31	44.6	ND	ND	6.97
FTA2	12H-3	9-14	2-23-88	450	ND	1.9	1.1	6.4	9.4	ND	ND	0.97
FTA2	12H-4	14-19	2-23-88	340	ND	0.24	0.89	4.0	5.13	ND	ND	1.32
FTA2	12H-5	19-25	2-23-88	5,760	ND	3.7	5.0	32	40.7	ND	ND	15.7
FTA2	12I-2	4-9	2-23-88	670	ND	1.7	1.3	8.6	11.6	ND	ND	4.35
FTA2	12I-3	9-14	2-24-88	450	0.54	2.2	5.6	35	42.8	ND	ND	3.2
FTA2	12I-5	19-24	2-24-88	1,250	ND	0.016	ND	0.0063	0.022	0.005	0.005	1.28
FTA2	12J-2	4-9	2-24-88	ND	ND	0.013	ND	ND	0.013	0.12	0.12	ND
FTA2	12J-3	9-14	2-24-88	ND	ND	ND	ND	ND	ND	0.0039	0.0039	ND
FTA2	12J-5	19-23	2-24-88	17.0	ND	0.0064	ND	ND	0.0064	0.0062	0.0062	ND
FTA2	12K-5	20-25	2-20-88	14.0	ND	0.0011	ND	ND	0.0011	ND	ND	ND

**TABLE 1**  
**PREVIOUS SOIL SAMPLING ANALYTICAL DATA SUMMARY**  
**SWMUs 19, 20, AND 53**  
**CARSWELL AIR FORCE BASE**  
**FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

AREA	BORING	DEPTH BGS (FT)	DATE	TPH (mg/kg) <sup>3</sup>	VOLATILE ORGANICS (mg/kg)						SEMI VOLATILE ORGANICS (mg/kg)
					BENZENE	TOLUENE	ETHYL BENZENE	XYLENE	TOTAL BTX	METHYLENE CHLORIDE	
FDD <sup>4</sup>	13G-1	0	3-5-88	1,130	0.011	0.16	0.75	3.9	4.82	ND	64.24
FDD	13G-2	0.1	3-31-88	410	ND	3.0	ND	ND	3.0	ND	7.93
FDD	13H-1	0	3-5-88	1,320	0.0031	0.034	0.011	0.063	0.11	ND	34.74
FDD	13H-2	0.1	3-31-88	3,500	ND	0.023	0.003	0.018	0.044	ND	5.0
FDD	13I-1	0	3-5-88	960	0.0075	0.36	0.017	0.15	0.535	ND	51.72
FDD	13I-2	0.1	3-31-88	99	ND	0.018	0.0021	0.014	0.034	ND	69.77
FDD	13J-1	0	3-5-88	420	0.003	0.0083	0.0037	0.02	0.035	ND	14.74
FDD	13J-2	0.1	3-31-88	230	0.0015	0.095	0.0051	0.036	0.138	ND	23.28
FDD	13K-1	0	3-5-88	34	0.0038	0.012	0.0041	0.028	0.048	ND	1.11
FDD	13K-2	0.1	3-31-88	55	0.0025	0.11	0.0044	0.021	0.138	0.0016	88.3

**NOTE**

- (1) Data received after contract started. Data from Radian RI/FS, April 1990.
- (2) All FTA2 samples collected within outer berm area of SWMU 19.
- (3) mg/kg = milligrams per kilogram or parts per million (ppm)
- (4) ND = Not Detected
- (5) All FDD samples collected in soils within SWMU 53.

**TABLE 2**  
**DELINEATION SAMPLING ANALYTICAL DATA SUMMARY**  
**SWMUs 19, 20, AND 53**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

			Analyte: TPH	B	T	E	X	BTEX
			Units: (mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Cleanup Goals:			100	NA	NA	NA	NA	30,000
Field I.D.	Depth	Lab I.D.						
DFT-1	0.5	1	5,300	<50	57	300	1,600	1,960
DFT-2	1.5	2	45	11	12	26	220	269
DFT-3	2.5	3	20	11	3.1	19	140	173
DFT-28 (D-3)	2.5	28	180	11	11	16	83	121
DFT-4	0.5	4	4,000	<2.0	<2.0	<2.0	4.9	4.9
DFT-5	1.5	5	13,000	1,300	4,300	2,600	13,000	21,200
DFT-6	2.5	6	8,300	1,500	4,700	3,300	16,000	25,500
DFT-7	0.5	7	1,500	<2.0	<2.0	<2.0	4.5	4.5
DFT-8	1.5	8	2,100	<200	710	1,100	7,100	8,910
DFT-9	2.5	9	150	<50	88	100	840	1,030
DFT-10	0.5	10	290	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-11	1.5	11	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-12	2.5	12	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-29 (D-12)	2.5	29	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-13	0.5	13	66	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-14	1.5	14	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-15	2.5	15	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-16	0.5	16	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-17	1.5	17	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-18	2.5	18	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-19	0.5	19	1,600	<2.0	<2.0	<2.0	62	62
DFT-20	1.5	20	<10	<2.0	12	42	280	334
DFT-21	2.5	21	23	<2.0	41	76	470	587
DFT-22	0.5	22	80	<2.0	19	2.4	120	141
DFT-23	1.5	23	95	<2.0	7.9	12	50	69.9
DFT-24	2.5	24	51	<2.0	14	<2.0	38	52
DFT-30 (D-24)	2.5	30	<10	<2.0	<2.0	<2.0	7.9	7.9
DFT-25	0.5	25	450	<2.0	<2.0	<2.0	<2.0	<2.0
DFT-26	1.5	26	2,300	<200	2,000	2,600	12,000	16,600
DFT-27	2.5	27	3,100	<50	2,100	3,000	12,000	17,100
AST-1	0.5	36	3,500	<2.0	<2.0	<2.0	<2.0	<2.0
AST-2	0.5	1	6,100	<2.0	<2.0	<2.0	<2.0	<2.0

Table 2, Page 1

**TABLE 2**  
**DELINEATION SAMPLING ANALYTICAL DATA SUMMARY**  
**SWMUs 19, 20, AND 53**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

Analyte:			TPH	B	T	E	X	BTEX
Units:			(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Cleanup Goals:			100	NA	NA	NA	NA	30,000
Field I.D.	Depth	Lab I.D.						
AST-3	0.5	2	2,800	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-1	0.5	1	120	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-2	NS							
DFLD-3	0.5	2	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-13 (D-3)	0.5	12	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-4	1.5	3	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-5	0.5	4	20	<2.0	<2.0	2.8	12.0	14.8
DFLD-6	1.5	5	37	<2.0	<2.0	<2.0	3.8	3.8
DFLD-7	0.5	6	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-8	1.5	7	<10	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-9	0.5	8	<10	<2.0	<2.0	2.0	11.0	13.0
DFLD-10	1.5	9	<10	<2.0	<2.0	<2.0	6.5	6.5
DFLD-11	0.5	10	93	<2.0	<2.0	<2.0	<2.0	<2.0
DFLD-12	1.5	11	<10	<2.0	<2.0	<2.0	<2.0	<2.0
FLD-7	0.5	9A	76	<2.0	<2.0	<2.0	5.9	5.9
Units:			mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
WFT-1	Surface Water	34	1.1	<1.0	<1.0	<1.0	<1.0	<1.0
WFLD-1	Surface Water	14	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0

**NOTES:**

TPH = Total Petroleum Hydrocarbon

&lt; = not detected at or above method detection limit

B = Benzene

T = Toluene

E = Ethylbenzene

X = Xylenes

BTEX = Total BTEX

mg/l = milligrams per liter

mg/kg = milligrams per kilogram or parts per million (ppm)

ug/l = micrograms per liter

ug/kg = micrograms per kilogram or parts per billion (ppb)

D-# = Duplicate Sample of #

NA = Not Applicable

NS = No sample collected at DFLD-2 due to hand auger refusal

**TABLE 3**  
**VERIFICATION SOIL SAMPLING ANALYTICAL DATA SUMMARY**  
**SWMUs 19 AND 20**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

Analyte:		TPH	B	T	E	X	BTEX
Units:		(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Cleanup Goals:		100	NA	NA	NA	NA	30,000
Field I.D.	Depth	Lab I.D.					
VFT-28	3.5	1	<10	<2	<2	<2	<2
VFT-29	3.5	2	1,100	4,900	3,200	17,000	25,300
VFT-30	3.5	3	<10	<2	<2	<2	<2
VFT-31	3.5	4	4,700	12,000	5,100	26,000	44,100
VFT-32 (D-31)	3.5	5	6,400	16,000	8,100	49,000	74,300
VAST-4	3.5	7	3,900	<50	260	1,500	1,830
VAST-5	3.5	8	38	<2.0	<2.0	<2.0	<2.0
			mg/l	ug/l	ug/l	ug/l	ug/l
BS-1 (Borrow Source)	0.0	13406	12	NA	NA	NA	NA
BS-2 (Borrow Source)	0.0	13407	<10	NA	NA	NA	NA
BC-1 (Biocell Water)	0.0	20897	0.50	<5.0	<5.0	<5.0	<5.0
LW-1 (Liner Water)	0.0	32726	<0.50	<5.0	<5.0	<5.0	<5.0
NOTES: TPH = Total Petroleum Hydrocarbon < = not detected at or above method detection limit B = Benzene T = Toluene E = Ethylbenzene X = Xylenes BTEX = Total BTEX mg/l = milligrams per liter mg/kg = milligrams per kilogram ug/l = micrograms per liter or parts per million (ppm) ug/kg = micrograms per kilogram or parts per billion (ppb) NA = Not Analyzed D-# = Duplicate Sample of #							

**TABLE 4**  
**INITIAL BIOCELL BASELINE AND**  
**PERIODIC SOIL SAMPLING ANALYTICAL DATA SUMMARY**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

SAMPLE NUMBER	DATE COLLECTED	GRID #	DESCRIPTION	TPH (mg/kg <sup>1</sup> )	BTEX (ug/kg <sup>2</sup> )	AVERAGE TPH (mg/kg) PER EVENT
BCUBGS-1	7-14-93	1	Soil Baseline	550	BDL <sup>3</sup>	NA <sup>4</sup>
BCUBGS-2	7-14-93	2	Soil Baseline	1,000	BDL	NA
BCUBGS-3	7-14-93	3	Soil Baseline	1,100	BDL	NA
BCUBGS-4	7-14-93	4	Soil Baseline	910	BDL	NA
BCUBGS-5	7-14-93	5	Soil Baseline	1,200	25.3	NA
BCUBGS-6	7-14-93	6	Soil Baseline	760	BDL	NA
BCUBGS-7	7-14-93	7	Soil Baseline	530	23.6	NA
BCUBGS-8	7-14-93	8	Soil Baseline	890	BDL	NA
BCUBGS-9	7-14-93	9	Soil Baseline	700	BDL	NA
BCUBGS-10	7-14-93	10	Soil Baseline	840	BDL	NA
BCUBGS-11	7-14-93	DUP	Duplicate 7	950	BDL	857
BCUBGS-12	7-14-93	COE	Split Sample	NA	NA	NA
BCUBGS-13	7-14-93	RW	Rinse Water	BDL	BDL	NA
BCU-14	8-16-93	1	1st BCU Progress Sampling	440	BDL	NA
BCU-15	8-16-93	2	1st BCU Progress Sampling	450	BDL	NA
BCU-16	8-16-93	3	1st BCU Progress Sampling	430	BDL	NA
BCU-17	8-16-93	4	1st BCU Progress Sampling	710	BDL	NA
BCU-18	8-16-93	5	1st BCU Progress Sampling	320	BDL	NA
BCU-19	8-16-93	6	1st BCU Progress Sampling	660	BDL	NA
BCU-20	8-16-93	7	1st BCU Progress Sampling	210	BDL	NA
BCU-21	8-16-93	8	1st BCU Progress Sampling	450	BDL	NA
BCU-22	8-16-93	9	1st BCU Progress Sampling	510	BDL	NA
BCU-23	8-16-93	10	1st BCU Progress Sampling	520	BDL	470
BCU-24	8-16-93	DUP	Duplicate 7	60	BDL	NA

Table 4, Page 1

**TABLE 4**  
**INITIAL BIOCELL BASELINE AND**  
**PERIODIC SOIL SAMPLING ANALYTICAL DATA SUMMARY**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

SAMPLE NUMBER	DATE COLLECTED	GRID #	DESCRIPTION	TPH (mg/kg <sup>1</sup> )	BTEX (ug/kg <sup>2</sup> )	AVERAGE TPH (mg/kg) PER EVENT
BCU-25	8-16-93	COE	Split Sample	NA	NA	NA
BCU-26	8-16-93	RW	Rinse Water	BDL	BDL	NA
BCU-27	9-17-93	1	2nd BCU Progress Sampling	330	BDL	NA
BCU-28	9-17-93	2	2nd BCU Progress Sampling	200	BDL	NA
BCU-29	9-17-93	3	2nd BCU Progress Sampling	130	BDL	NA
BCU-30	9-17-93	4	2nd BCU Progress Sampling	260	BDL	NA
BCU-31	9-17-93	5	2nd BCU Progress Sampling	200	BDL	NA
BCU-32	9-17-93	6	2nd BCU Progress Sampling	190	BDL	NA
BCU-33	9-17-93	7	2nd BCU Progress Sampling	160	BDL	NA
BCU-34	9-17-93	8	2nd BCU Progress Sampling	230	BDL	NA
BCU-35	9-17-93	9	2nd BCU Progress Sampling	130	BDL	NA
BCU-36	9-17-93	10	2nd BCU Progress Sampling	280	BDL	211
BCU-37	9-17-93	DUP	Duplicate 5	210	BDL	NA
BCU-38	9-17-93	COE	Split Sample	NA	NA	NA
BCU-39	9-17-93	RW	Rinse Water	BDL	BDL	NA
BCU-40	10-18-93	1	3rd BCU Progress Sampling	49	BDL	NA
BCU-41	10-18-93	2	3rd BCU Progress Sampling	36	BDL	NA
BCU-42	10-18-93	3	3rd BCU Progress Sampling	69	BDL	NA
BCU-43	10-18-93	4	3rd BCU Progress Sampling	121	BDL	NA
BCU-44	10-18-93	5	3rd BCU Progress Sampling	50	BDL	NA
BCU-45	10-18-93	6	3rd BCU Progress Sampling	43	BDL	NA
BCU-46	10-18-93	7	3rd BCU Progress Sampling	57	BDL	NA
BCU-47	10-18-93	8	3rd BCU Progress Sampling	50	BDL	NA
BCU-48	10-18-93	9	3rd BCU Progress Sampling	125	BDL	NA

**TABLE 4**  
**INITIAL BIOCELL BASELINE AND**  
**PERIODIC SOIL SAMPLING ANALYTICAL DATA SUMMARY**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

SAMPLE NUMBER	DATE COLLECTED	GRID #	DESCRIPTION	TPH (mg/kg <sup>1</sup> )	BTEX (ug/kg <sup>2</sup> )	AVERAGE TPH (mg/kg) PER EVENT
BCU-49	10-18-93	10	3rd BCU Progress Sampling	50	BDL	65
BCU-50	10-18-93	DUP	Duplicate 1	27	BDL	NA
BCU-51	10-18-93	RW	Rinse Water	1.6	BDL	NA
BCU-52	10-18-93	COE	Split Sample	NA	NA	NA
BCU-53	11-4-93	4	4th BCU Progress Sampling	90	BDL	NA
BCU-54	11-4-93	9	4th BCU Progress Sampling	186	BDL	138

**NOTES:**

- (1) mg/kg = milligrams per kilogram or parts per million (ppm)
- (2) ug/kg = micrograms per kilogram or parts per billion (ppb)
- (3) BDL = Below Detection Limits
- (4) NA = Not Analyzed/or Not Applicable

**TABLE 5**  
**BIOCELL VERIFICATION SOIL SAMPLING ANALYTICAL DATA SUMMARY**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR**  
**U.S. ARMY CORPS OF ENGINEERS**

ID No.	TPH (418.1) <sup>1</sup>		ID No.	TPH (418.1)	EXTRACTABLE TPH (8000)		ID No.	TPH (418.1)
B-1	214		B-51	314			B-101	244
B-2	350		B-52	228			B-102	137
B-3	323		B-53	281				
B-4	290		B-54	167			B-126 (Resample of B-9)	310
B-5	260		B-55	434			B-127 (B-27)	226
B-6	280		B-56	355			B-128 (B-18)	385
B-7	210		B-57	260			B-129 (B-36)	250
B-8	240		B-58	623	< 10		B-130 (B-54)	294
B-9	270		B-59	253			B-131 (B-45)	127
B-10	300		B-60	524	< 10		B-132 (B-63)	350
B-11	257		B-61	580	13		B-133 (B-81)	190
B-12	336		B-62	362			B-134 (B-72)	346
B-13	250		B-63	394	10		B-135 (B-90)	380
B-14	244		B-64	300			B-136 (B-99)	198
B-15	210		B-65	234				
B-16	370		B-66	310				
B-17	370		B-67	330				
B-18	286		B-68	373				
B-19	310		B-69	450	25			
B-20	307		B-70	294				
B-21	386		B-71	256				
B-22	464		B-72	300				
B-23	220		B-73	216				
B-24	230		B-74	295				
B-25	211		B-75	160				
B-26	185		B-76	132				
B-27	326		B-77	208				
B-28	180		B-78	194				
B-29	194		B-79	260				
B-30	153		B-80	310	< 10			
B-31	200		B-81	260				
B-32	140		B-82	210				
B-33	176		B-83	200				
B-34	233		B-84	200				
B-35	177		B-85	207				
B-36	163		B-86	350				
B-37	257		B-87	460	46			
B-38	160		B-88	400				
B-39	266		B-89	332				
B-40	408		B-90	230				
B-41	200		B-91	315				
B-42	276		B-92	475				
B-43	246		B-93	340				
B-44	234		B-94	231				
B-45	120		B-95	183				
B-46	220		B-96	172				
B-47	154		B-97	225				
B-48	186		B-98	246				
B-49	162		B-99	256				
B-50	526		B-100	159				

NOTE: (1) TPH = Total Petroleum Hydrocarbons by EPA Test Method 418.1 (and EPA Test Method 8000 for comparison) in mg/kg or parts per million (ppm)  
 (2) All BTEX data were below method detection limits.

# TAB

FIGURES

**FIGURES**

FILE NO: 11851-010-135

REVISIONS:

DATE: 2-16-95

APPROVED BY: NEJ

DATE: 2-16-95

CHECKED BY: NEJ

DATE: 2-16-95

DRAWN BY: [Signature]

246 50

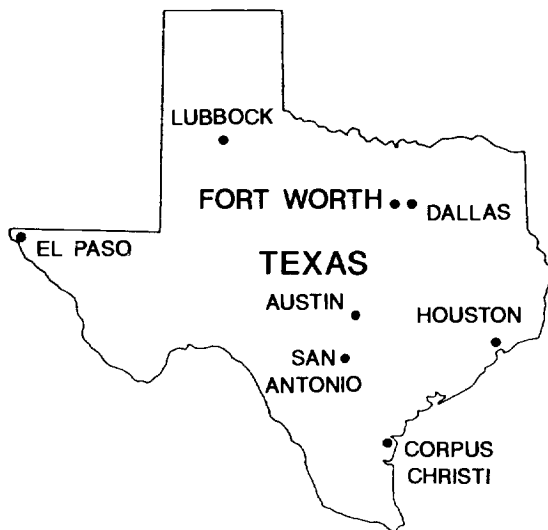
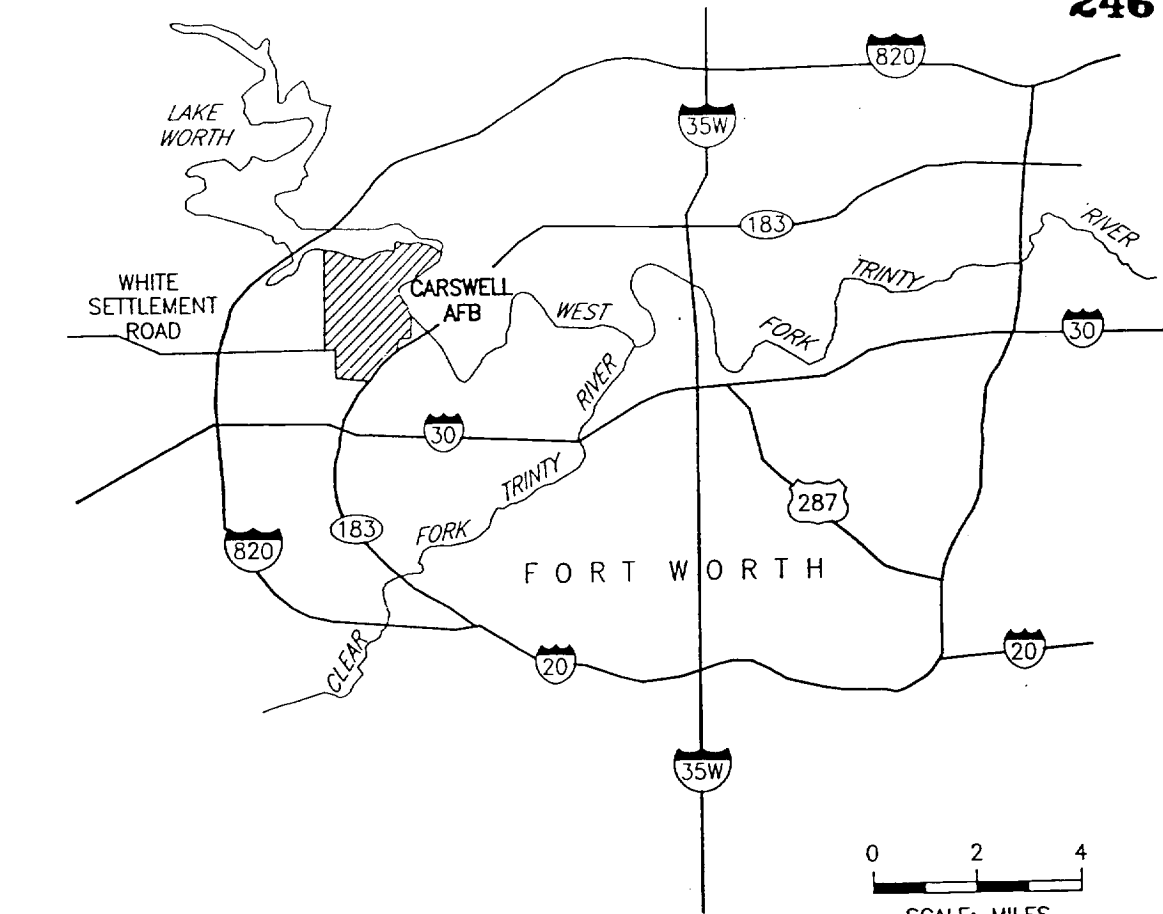


FIGURE 1  
VICINITY MAP  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS  
for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT

SOURCE : U.S. ARMY CORPS OF ENGINEERS  
RFP FOR CARSWELL AFB

DAMES & MOORE

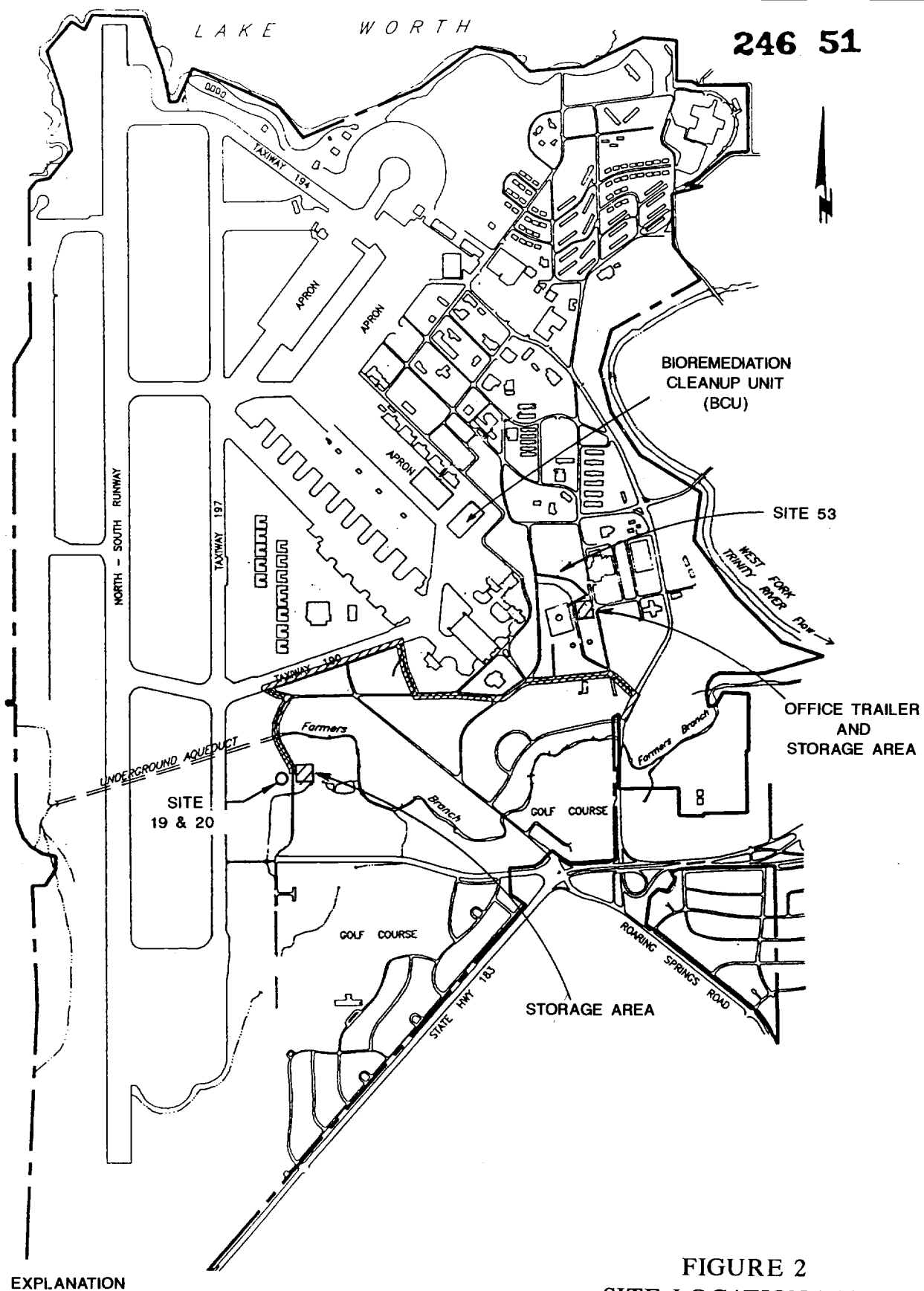


FIGURE 2  
SITE LOCATION MAP  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS

for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT

DAMES & MOORE

SOURCE : U.S. ARMY CORPS OF ENGINEERS  
RFP FOR CARSWELL AFB

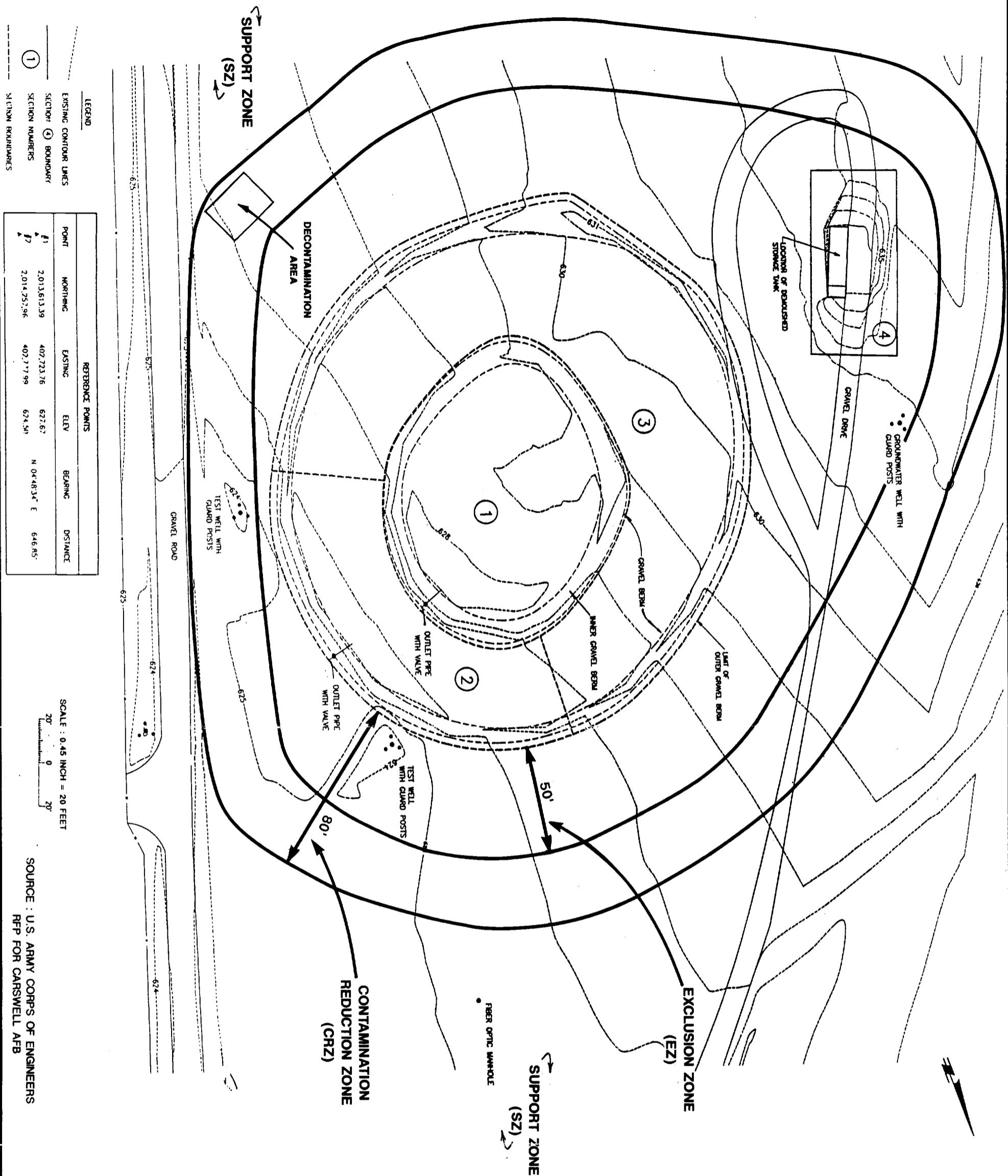


FIGURE 3  
SWMU 19 & 20  
FORMER FIRE TRAINING AREA  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS  
for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE

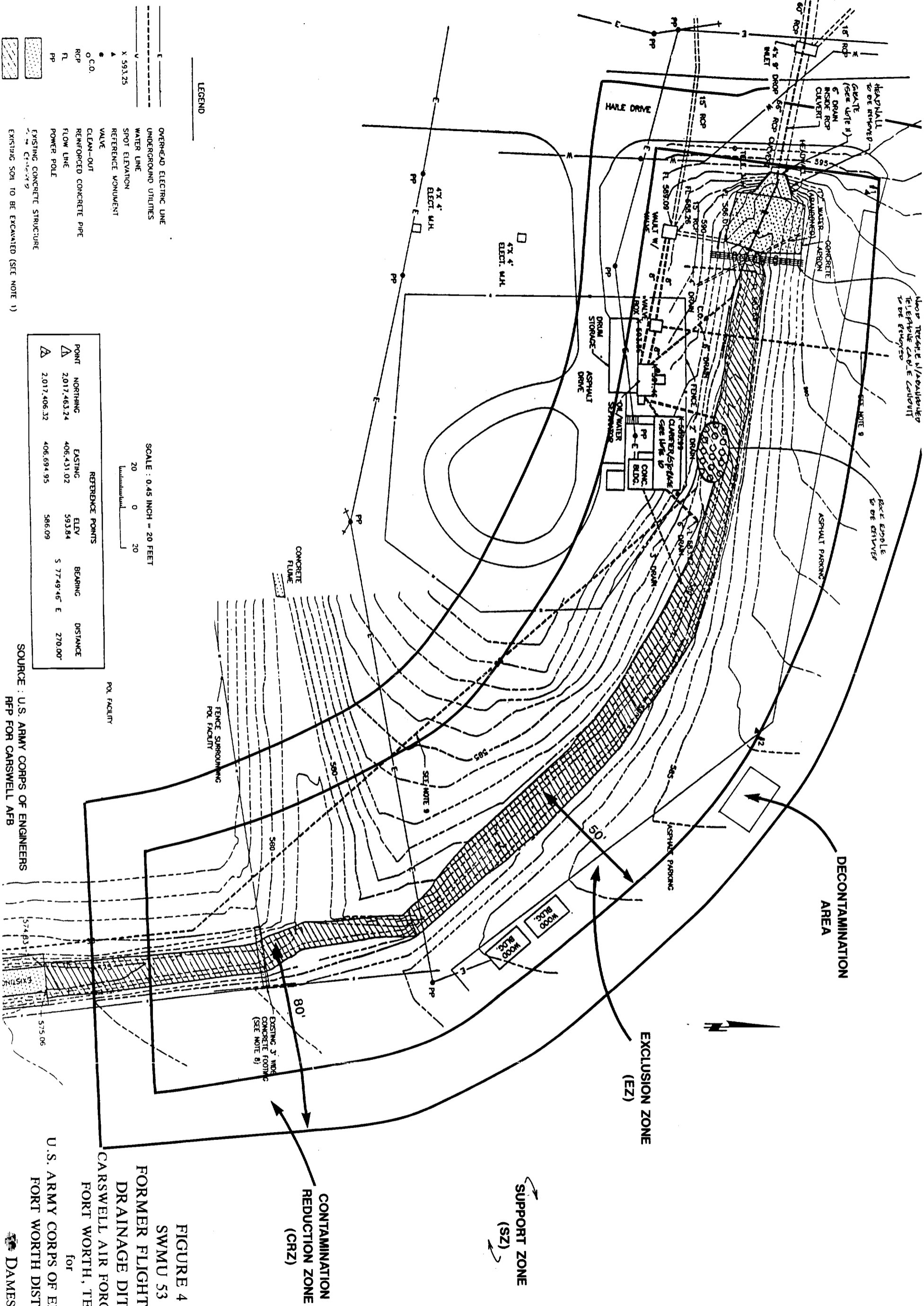


FIGURE 4  
SWMU 53  
FORMER FLIGHTLINE  
DRAINAGE DITCH  
for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE

- EXPLANATION**

  - SOIL SAMPLING LOCATION
  - △ POSSIBLE WATER SAMPLING LOCATION
  - EXISTING CONTOUR LINES
  - ① SECTION: ① BOUNDARY
  - ② SECTION: ② BOUNDARY
  - ③ SECTION: ③ BOUNDARY
  - ④ SECTION: ④ BOUNDARY
- DFT-1 (0.5')

DFT-2 (1.5')

DFT-3 (2.5')

DFT-30D = DUPLICATE SAME DEPTH (2.5')

REFERENCE POINTS			
POINT	NORTHING	EASTING	ELEV
1	2,013,613.39	407,723.76	627.67
2	2,014,257.96	407,777.98	624.50

BEARING	DISTANCE
N 04°48'34" E	646.85'

SCALE : 0.45 INCH = 20 FEET

20' 0 20'

SOURCE : U.S. ARMY CORPS OF ENGINEERS  
RFP FOR CARSWELL AFB

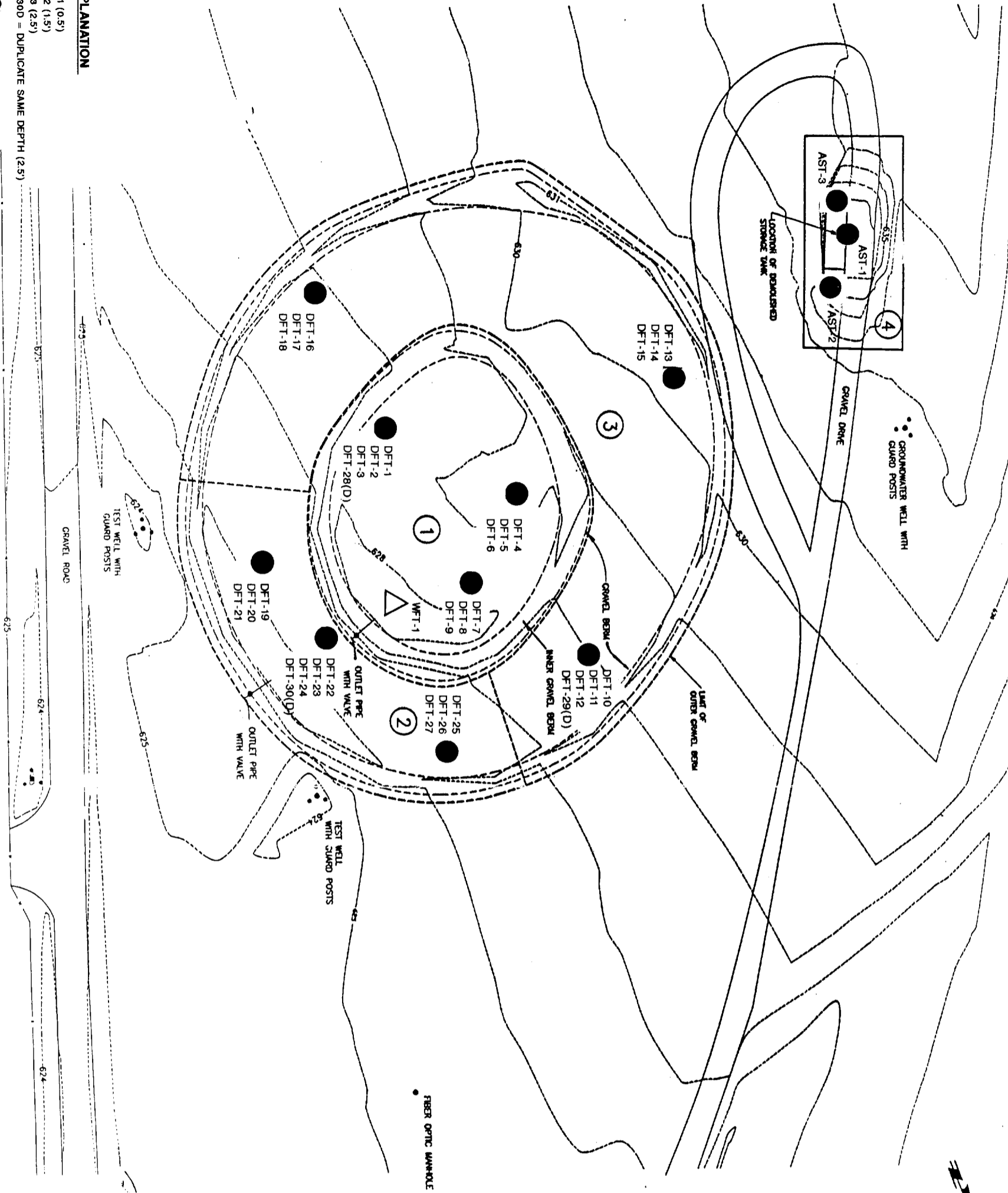
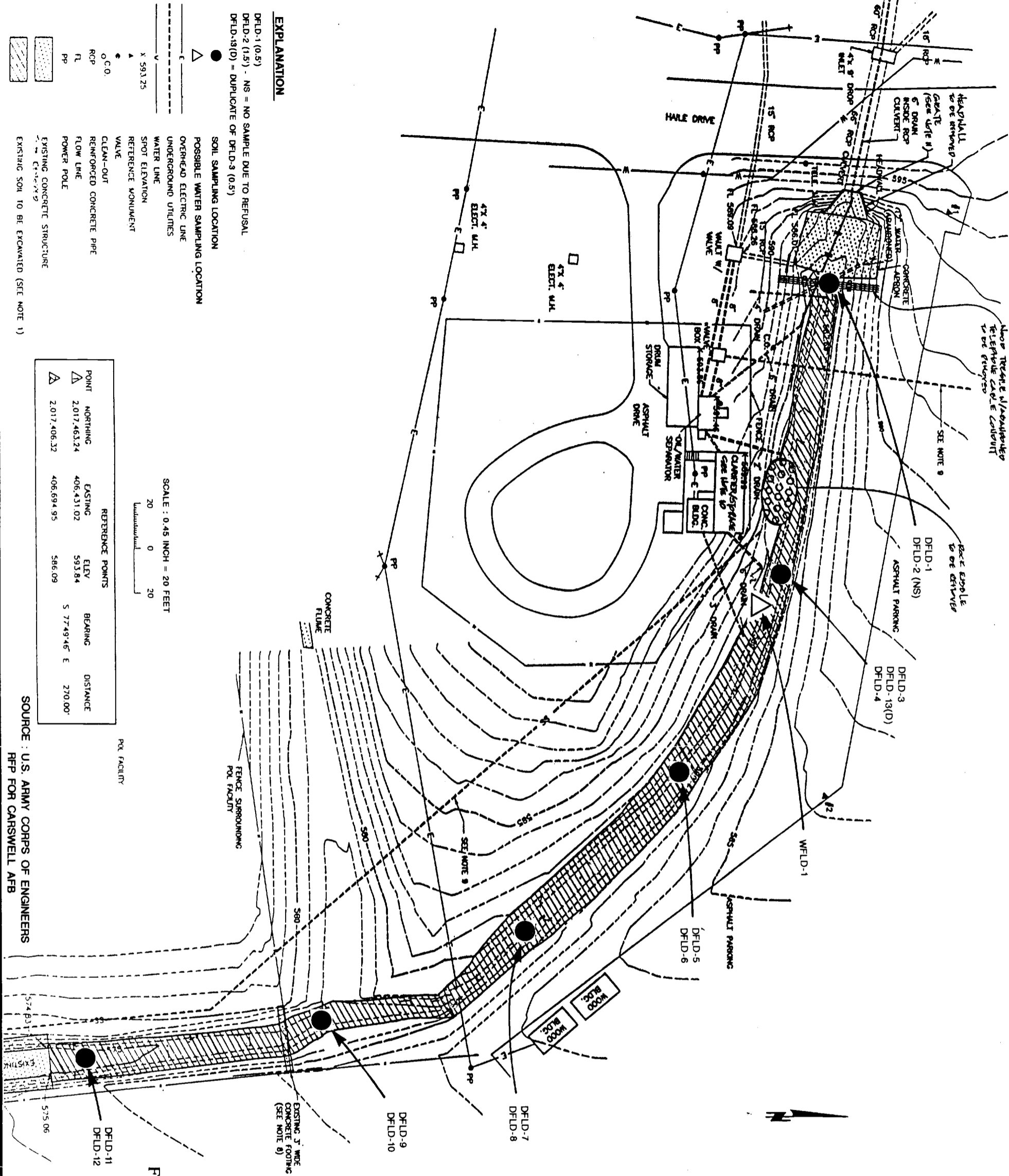


FIGURE 5

INITIAL CHARACTERIZATION  
SAMPLING LOCATIONS  
FORMER FIRE TRAINING AREA  
SWMU'S 19 & 20  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS

for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE



POINT NORTHING EASTING ELEV BEARING DISTANCE

POINT	2.017.463.24	406.431.02	593.84	S 77°49'46" E	270.00'
POINT	2.017.406.32	406.694.95	586.09		

SOURCE: U.S. ARMY CORPS OF ENGINEERS  
RFP FOR CARSWELL AFB

FIGURE 6  
INITIAL CHARACTERIZATION  
SAMPLING LOCATIONS  
FORMER FLIGHTLINE DRAINAGE DITCH  
SWMU 53  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS  
for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE

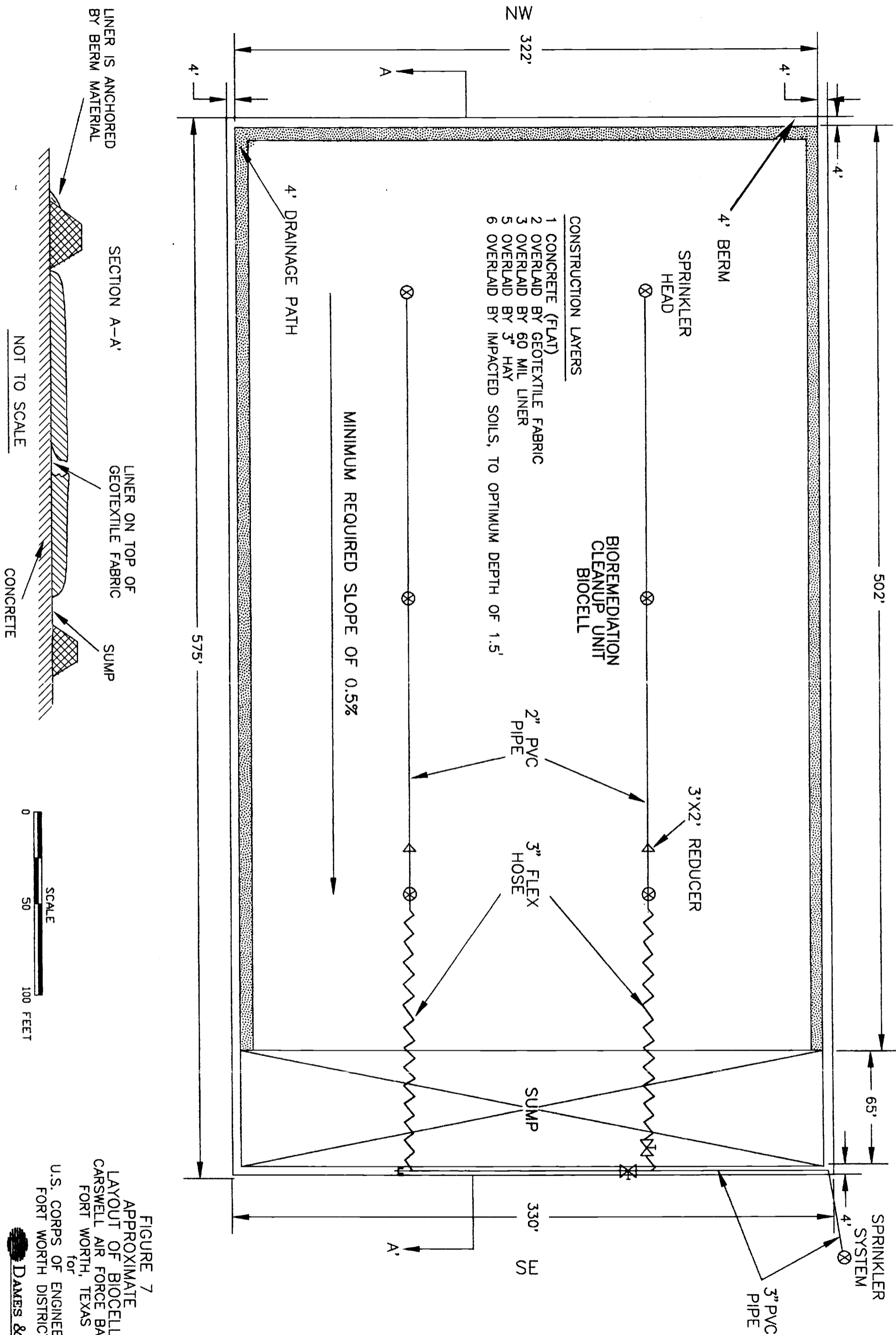


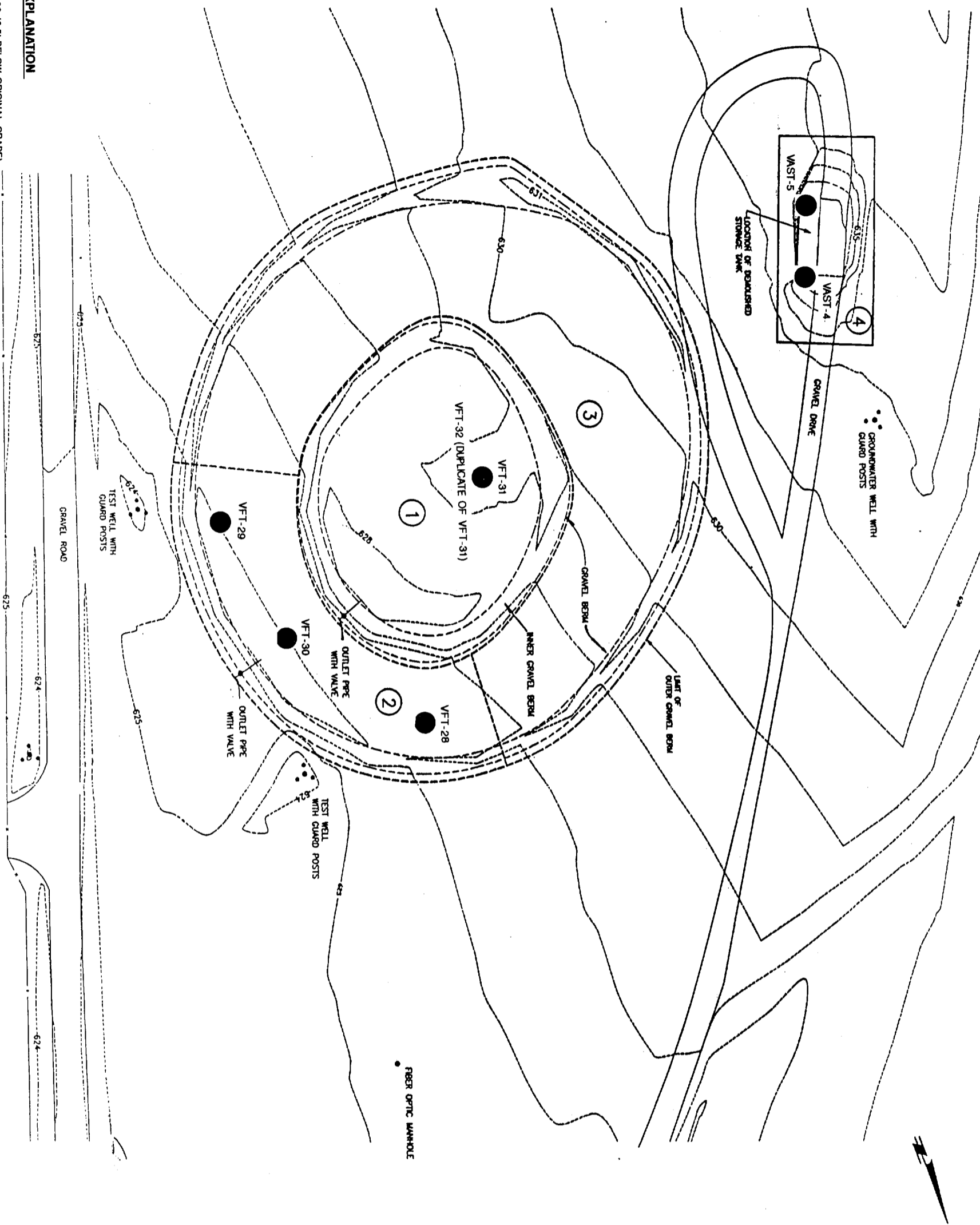
FIGURE 7  
APPROXIMATE  
LAYOUT OF BIOCELL  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS  
for  
U.S. CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE

- EXPLANATION**
- SOIL SAMPLING LOCATION
  - EXISTING CONTOUR LINES
  - ③ BOUNDARY
  - ① SECTION NUMBERS
  - SECTION BOUNDARIES
- VFT-28 (3.5' BELOW ORIGINAL GRADE)

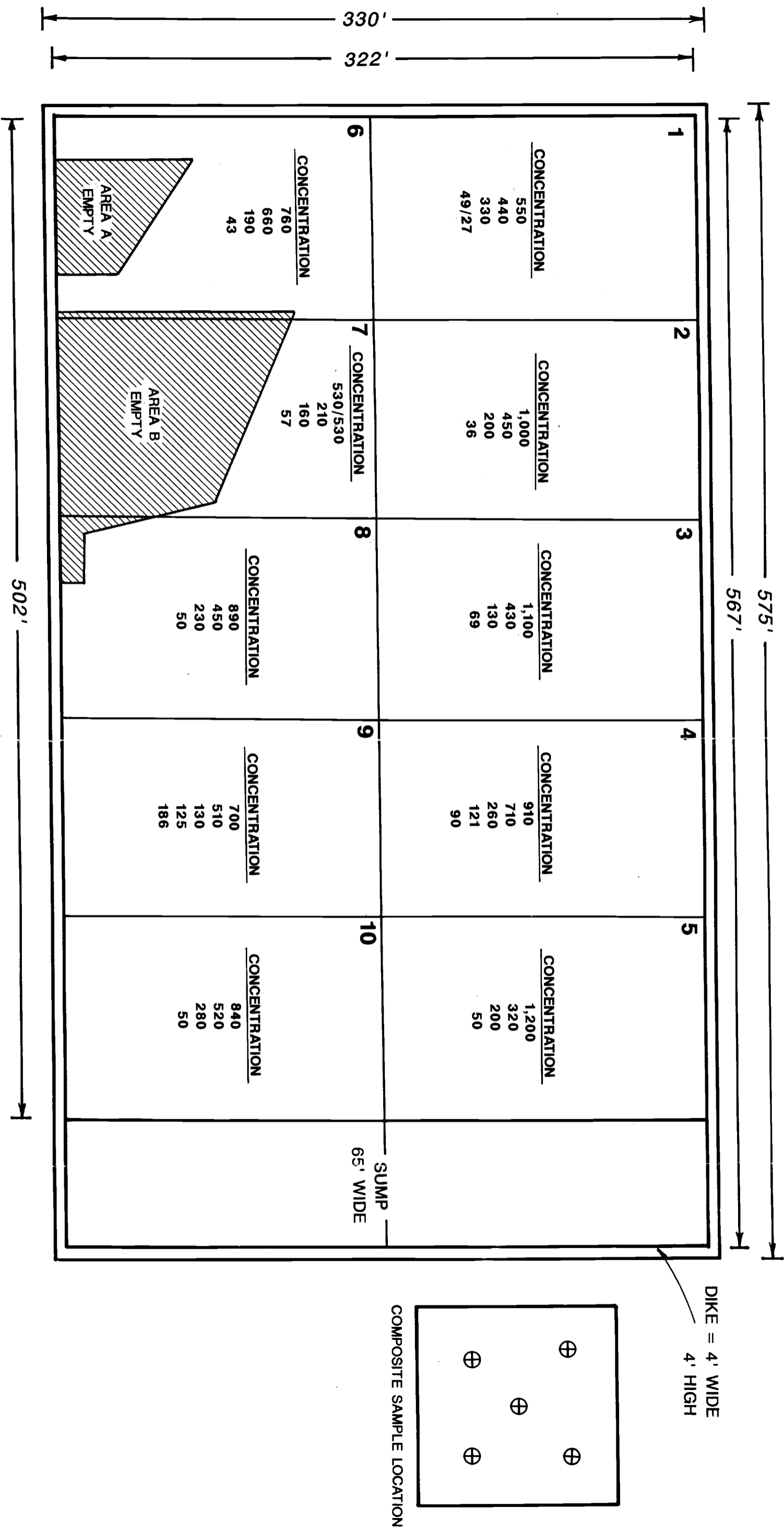
REFERENCE POINTS				
POINT	NORTHING	EASTING	ELEV	BEARING
1	2,013,613.39	402,723.76	622.67	N 04°48'34" E 646.85'
2	2,014,252.96	402,777.99	624.50	

SCALE : 0.45 INCH = 20 FEET

20' 0 20'



**FIGURE 8**  
**VERIFICATION**  
**SAMPLING LOCATIONS**  
**FORMER FIRE TRAINING AREA**  
**SWMU'S 19 & 20**  
**CARSWELL AIR FORCE BASE**  
**FORT WORTH, TEXAS**  
for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE



HIGH CONCENTRATION	
BASELINE - 1,200 - JULY 26, 1993 - SAMPLING	857
1ST EVENT - 710 - AUGUST 16, 1993 - SAMPLING	470
2ND EVENT - 330 - SEPTEMBER 17, 1993 - SAMPLING	211
3RD EVENT - 125 - COTOBER 18, 1993 - SAMPLING	64
4TH EVENT - 186 - NOVEMBER 4, 1993 - SAMPLING	138

SCALE: 1"=50'  
APPROXIMATE

FIGURE 9  
INITIAL BASELINE AND PERIODIC  
BIOCELL SCREENING SAMPLE GRIDS  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS  
for  
U.S. CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE

246 53

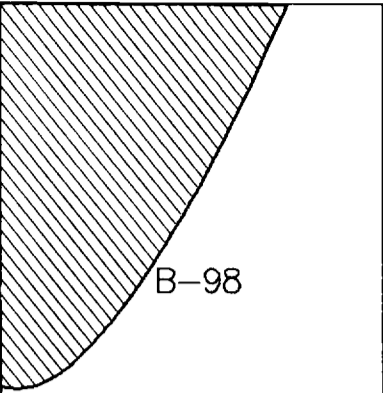
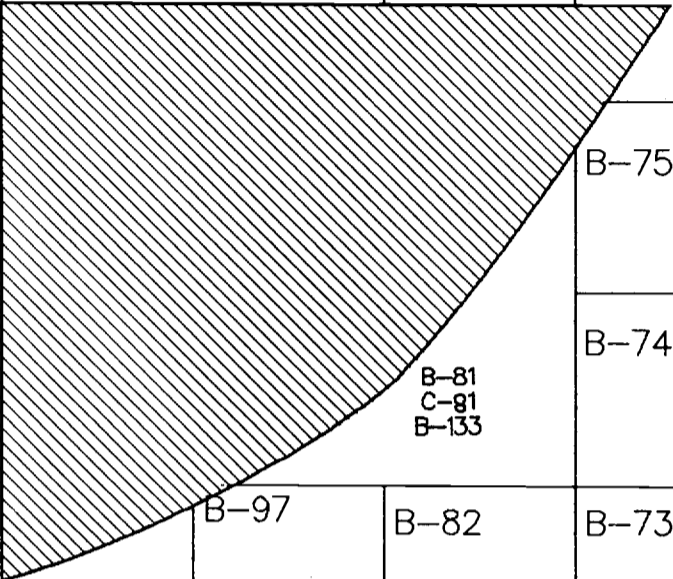
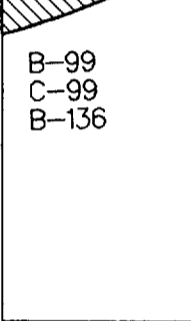
 B-98		B-79	B-78	B-53	B-52	B-27 C-27 B-127	B-26	B-1
		B-80	B-77	B-54 C-54 B-130	B-51	B-28	B-25	B-2
 B-81 C-81 B-133			B-76	B-55	B-50	B-29	B-24	B-3
			B-75	B-56	B-49	B-30	B-23	B-4
			B-74	B-57	B-48	B-31	B-22	B-5
 B-99 C-99 B-136	B-97	B-82	B-73	B-58	B-47	B-32	B-21	B-6
	B-96	B-83	B-72 C-72 B-134	B-59	B-46	B-33	B-20	B-7
B-100	B-95	B-84	B-71	B-60	B-45 C-45 B-131	B-34	B-19	B-8
	B-94	B-85	B-70	B-61	B-44	B-35	B-18 C-18 B-128	B-9 C-9 B-126
B-101	B-93	B-86	B-69	B-62	B-43	B-36 C-36 B-129	B-17	B-10
	B-92	B-87	B-68	B-63 C-63 B-132	B-42	B-37	B-16	B-11
B-102	B-91	B-88	B-67	B-64	B-41	B-38	B-15	B-12
	B-90 C-90 B-135	B-89	B-66	B-65	B-40	B-39	B-14	B-13

FIGURE 10  
FINAL BIOCELL VERIFICATION  
SAMPLE LOCATIONS  
CARSWELL AIR FORCE BASE  
FORT WORTH, TEXAS  
for  
U.S. ARMY CORPS OF ENGINEERS  
FORT WORTH DISTRICT  
DAMES & MOORE

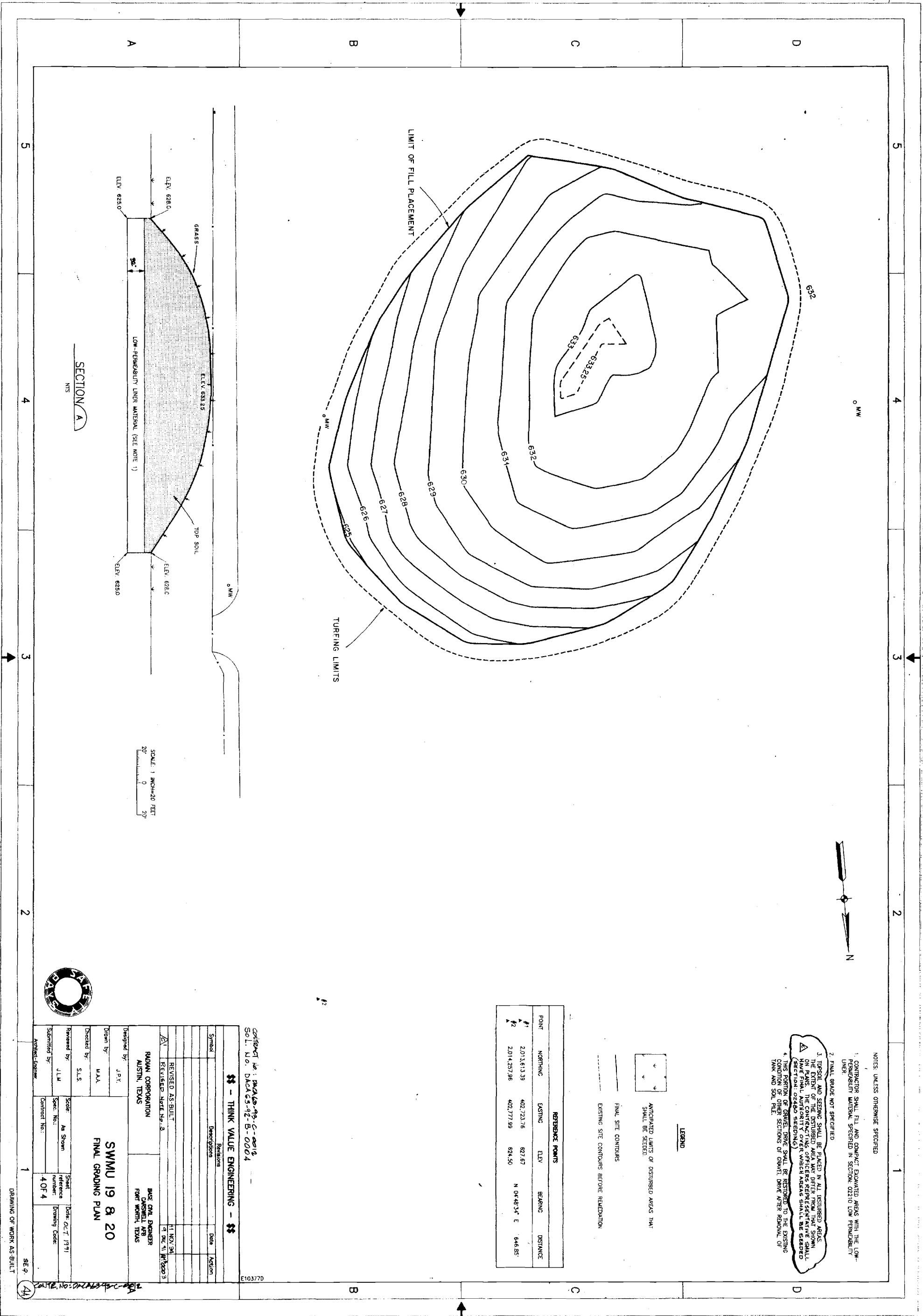


FIGURE 11



# TAB

APPENDIX A

APPENDIX A  
CHRONOLOGY OF EVENTS

**APPENDIX A**  
**REMEDIATION OF SWMUs 19, 20 AND 53**  
**CARSWELL AIR FORCE BASE, FORT WORTH, TEXAS**  
**FOR U.S. ARMY CORPS OF ENGINEERS**  
**CONTRACT NO. DACA63-93-C-0012**

**CHRONOLOGY OF EVENTS**

<u>Contract Day/Date</u>	<u>Description of Activity</u>
000 November 3, 1992	Dames & Moore CORE Services receives Acceptance of Bid for Remediation of SWMUs 19, 20 and 53 under Solicitation DACA63-92-B-0004.
000 January 21, 1993	Dames & Moore, Inc., dba Dames & Moore CORE Services (Dames & Moore) receives Notice to Proceed from the United States Army Corps of Engineers (USACOE) for Remediation of SWMUs 19, 20 and 53 under Solicitation No. DACA63-92-B-0004 as Contract No. DACA 63-93-C-0012.
000 January 26, 1993	Dames & Moore participated in Pre-Construction Meeting at Carswell Air Force Base (CAFB) with Carswell and USACOE personnel. This meeting constituted the first day of the contract. Dames & Moore presented USACOE with verbal request for additional work and Bio Bench Scale Testing.
003 January 29, 1993	<p>Dames &amp; Moore began writing work plans:</p> <ul style="list-style-type: none"> <li>+ Health &amp; Safety Plan (Accident Prevention Plan/Emergency Response Plan)</li> <li>+ General Site Work Plan</li> <li>+ Materials Handling Plan (Spill Control and Discharge Plan)</li> <li>+ Asbestos Removal and Disposal Plan</li> <li>+ Quality Control Sampling Plan</li> <li>+ Contractor Quality Control Plan</li> <li>+ Environmental Protection Plan</li> </ul>

CHRONOLOGY OF EVENTS

006

February 1, 1993

Todd Smith (USACOE) advised Dames & Moore that Biocell and Trailer locations had changed. Dames & Moore continues to work on passes, I.D. info and Work Plans.

007

February 2, 1993

Dames & Moore (Brett Battenfield) phones Captain Manning (CAFB) to discuss new haul route from SWMUs 19 and 20 to Biocell.

010

February 5, 1995

Dames & Moore submits all Draft Work Plans to USACOE/CAFB.

021

February 16, 1993

Dames & Moore, as requested in Preconstruction Meeting of January 26, 1993, submitted Contract Modification Request to conduct additional site investigation work and Bio Bench Scale Testing. Dames & Moore met with Jobie Smith (USACOE) to discuss Tasks 1 through 4 in this request.

038

March 5, 1993

USACOE sent letter to Dames & Moore stating that they appreciated our concerns and recommendations but would not authorize the additional work (Site Investigation, Bio Bench Scale Testing and Verification Sampling) and wanted us to stick to the contract as written.

049

March 16, 1993

Todd Smith (USACOE) gave approval on all appropriate Work Plans and the approval to conduct initial delineation sampling at SWMUs 19, 20 and 53.

050

March 17, 1993

Dames & Moore contacted John Newlin (CAFB) to locate utilities and obtain written verification of new Biocell location. Mr. Newlin indicated that no Flightline Pass would be needed to sample.

052

March 19, 1993

Dames & Moore finalized and submitted all Work Plans which addressed all USACOE/CAFB comments.

CHRONOLOGY OF EVENTS

056

March 23, 1993

Sampling for SWMUs 19 and 20 called off due to CAFB lack of utility clearance.

057

March 24, 1993

Dames & Moore submitted listing of samples to be collected at SWMUs 19, 20 and 53 per contract requirements. Dames & Moore arrived at CAFB to sample SWMUs 19 and 20 but John Newlin (CAFB) was overruled about the need for Flightline Pass and ID's required. After delay, Dames & Moore sampled SWMUs 19 and 20 (initial delineation samples, DFT1-DFT-30, and AST-1).

058

March 25, 1993

Dames & Moore arrived at CAFB to collect initial delineation samples at SWMU 53. CAFB was conducting a mock acid spill in area, and sampling efforts were delayed. Collected samples at SWMU 53 (DFLD-1 - DFLD-13).

065

March 30, 1993

Dames & Moore transmitted to USACOE a hard copy of the preliminary initial delineation sampling results of SWMUs 19, 20 and 53.

064

March 31, 1993

John Newlin (CAFB) verified all utility locations at the site. New Biocell location was verified and marked off.

065

April 1, 1993

Dames & Moore (Brett Battenfield) asked John Newlin (CAFB) to provide the new Biocell size and location in writing for the file.

069

April 5, 1993

Dames & Moore received written verification of new Biocell location. Necessary permits were set up; however, CAFB did not have the correct number of permits and correct dates of activities, and we were held up for our subcontractor's site meeting. USACOE gave final approval of Contractor Quality Control Plan (CQCP) and the approval to conduct initial field work.

CHRONOLOGY OF EVENTS

- 071  
April 7, 1993  
Graham Associates, Inc. of Fort Worth, Texas surveyed the existing (pre-excavation) conditions at SWMUs 19, 20 and 53.
- 072  
April 8, 1993  
Asbestos piping removed from SWMU 53 today.
- 076  
April 12, 1993  
Graham Associates, Inc. surveys the Biocell for current slope.
- 084  
April 20, 1993  
Flightline passes obtained from CAFB for subcontractors. Demolition activities were commenced at SWMUs 19 and 20.
- 085  
April 21, 1993  
8,500 gallon AST removed from SWMU 20.
- 090  
April 26, 1993  
HDPE liner delivered to CAFB for use at Biocell. A total of 25 dumpsters were removed from SWMU 19. Dames & Moore collected 2 more delineation samples at SWMU 20 (AST-2 and AST-3).
- 091  
April 27, 1993  
Biocell sprinkler system design commenced by Dames & Moore.
- 093  
April 29, 1993  
Dames & Moore presents the Final Report of Asbestos Removal Project to USACOE. The filter fabric for use as bottom layer of Biocell is delivered today. Dames & Moore submitted to USACOE the documentation for AST/dumpster/debris removal from SWMUs 19 and 20.
- 094  
April 30, 1993  
Dames & Moore submitted to USACOE the preliminary analytical results from SWMU 20.
- 097  
May 3, 1993  
Graham Associates, Inc. surveys SWMU 53 and Biocell existing conditions, cell is 330' by 575'.

CHRONOLOGY OF EVENTS

099 May 5, 1993	Dames & Moore subcontractor, Team Consultants, picked up clay borrow samples (BS-1 and BS-2) for use in Biocell berms and site backfill operations.
100 May 6, 1993	The results of the two clay borrow samples exhibit TPH levels of 12 ppm (BS-1) and < 10 ppm (BS-2).
104 May 10, 1993	Dames & Moore commences construction of Biocell clay berms.
107 May 13, 1993	Dames & Moore provided USACOE with clay borrow source sample data.
111 May 17, 1993	Dames & Moore laid down the filter fabric and liner of the Biocell.
114 May 20, 1993	Dames & Moore commences excavation and stockpiling at SWMUs 19 and 20.
119 May 25, 1993	Dames & Moore commences hauling stockpiled soils at SWMUs 19 and 20 to the Biocell.
120 May 26, 1993	Excess pipe underground at SWMUs 19 and 20 discovered beyond excavation limits.
126 June 1, 1993	Graham Associates, Inc. survey in the grades at SWMUs 19 and 20 and Biocell. Biocell sprinkler system is designed.
129 June 4, 1993	Todd Smith (USACOE) gave approval for Dames & Moore to excavate from 2' to 3' bgs in tank and line area at SWMUs 19 and 20.

CHRONOLOGY OF EVENTS

132

June 7, 1993

Demolition of the concrete headwall area at SWMU 53 commences, and Dames & Moore noticed red waste emanating out of uncovered soil. This information immediately forwarded (along with our concerns of project impact) to USACOE. Graham Associates, Inc. survey the new grades at SWMUs 19 and 20.

133

June 8, 1993

A total of 690 full tandem dump truck loads have been delivered from SWMUs 19 and 20 (only) to the Biocell for treatment.

134

June 9, 1993

Dames & Moore collects verification samples at SWMUs 19 and 20 (VFT-28-VFT-32; and AST-4 and AST-5). While excavating concrete, Dames & Moore encounters black oily substance at SWMU 53. Todd Smith (USACOE) directs Dames & Moore to collect black material sample for analysis (FLD-7) and to put boom in creek. Directed by Mr. Smith to cut 1' off sides of ditch to grass of SWMU 53 from 0+00 to 1+00 and from 4+50 to the end of the ditch. TNRCC representatives, Cecil Irby and Dana Mereck, were on-site to split samples. Split samples collected at all sampling events were also sent to the USACOE laboratory.

139

June 14, 1993

Dames & Moore rebuilds CAFB water pump. Todd Smith (USACOE) wants work suspended at SWMU 53 and 24 hour notice prior to reexcavation of SWMU 53 without a USACOE representative present.

140

June 15, 1993

Sample results for SWMU 19, 20 and 53 are received, and Dames & Moore had meeting at USACOE to discuss what to do at SWMU 53.

141

June 16, 1993

Graham Associates, Inc. surveys SWMU 19 and 20 now excavated to 3' bgs and Biocell soil quantity. Dames & Moore submits preliminary verification samples at SWMU 19 and 20 and periodic samples of identified wastes at SWMU 53.

CHRONOLOGY OF EVENTS

- 146  
June 21, 1993  
USACOE, Debbie Fitzgerald, visits SWMU 53, sees waste material and understands that a larger problem exists.
- 149  
June 24, 1993  
Dames & Moore met with USACOE to discuss SWMU 53, and USACOE requests Dames & Moore to develop a proposal to delineate/sample SWMU 53.
- 150  
June 25, 1993  
Dames & Moore discussed current releases at SWMU 53, the need for state disclosure; and, USACOE shut job down at SWMU 53.
- 153  
June 28, 1993  
USACOE directed Dames & Moore to backfill SWMUs 19 and 20; however, Dames & Moore did not backfill pending a ruling about filling in the excavation since verification samples were still above cleanup goals. Dames & Moore submitted the proposal to collect six additional samples at SWMU 53 to the USACOE. The USACOE rejected the sampling proposal.
- 154  
June 29, 1993  
USACOE sends Dames & Moore a Suspension of Work notice for work at SWMU 53 while they undertake an investigation of this area.
- 156  
July 1, 1993  
Dames & Moore provides the USACOE with the analytical data for the low permeability clay liner material for backfilling of SWMUs 19, 20 and 53.
- 169  
July 14, 1993  
Dames & Moore conducts initial background sampling of 10 grids of Biocell (BCUBGS-1 - BCUBGS-13), and the average TPH value was 857 parts per million (ppm).
- 170  
July 15, 1993  
Dames & Moore collects samples at SWMU 53 and turns them over to USACOE for analysis.

CHRONOLOGY OF EVENTS

175

July 20, 1993

Dames & Moore presents USACOE with Contract Modification Request for out-of-scope sampling of waste materials at SWMU 53.

176

July 21, 1993

Dames & Moore met with USACOE and CAFB personnel to discuss work stoppage at SWMU 53. Dames & Moore presented USACOE with letter request for extras encountered due to conditions at SWMU 53 and requested direction as to how to proceed. Dames & Moore pointed out that the request by USACOE to backfill clay liner in SWMUs 19 and 20 deviates from contract since levels were above cleanup goals. Dames & Moore also reminded USACOE that they did not provide Dames & Moore with Bio Bench Scale data or allow us to perform a Bio Bench Scale Test to show that Bioremediation would meet cleanup goals. Dames & Moore notified USACOE that we assume no liability for failure to meet clean up goals. Dames & Moore recommended to USACOE to report the encountered waste at SWMU 53 to the state.

178

July 23, 1993

Dames & Moore ordered two tons (80 bags) of fertilizer (20-30-0) for Biocell. Still holding off on backfilling SWMUs 19 and 20. SWMU 53 still on hold.

182

July 27, 1993

USACOE sends letter to Dames & Moore releasing us from the requirement to achieve cleanup goals at SWMUs 19 and 20 and to proceed with putting clay liner down. USACOE releases Dames & Moore from any liability for not attaining clean closure at SWMUs 19, 20 and 53.

184

July 29, 1993

USACOE lifts Suspension of Work in the CESWF-AO-NT letter dated June 29, 1993, with modification No. P00004, DO-C9069. USACOE directs Dames & Moore to only excavate necessary soils to lay new drainage system at SWMU 53. USACOE releases Dames & Moore from bioremediating the impacted excavated soils at SWMU 53 and the requirements to meet cleanup goals, collect verification samples, and treat and dispose of soil. USACOE directed Dames & Moore to excavate and

CHRONOLOGY OF EVENTS

stockpile SWMU 53 soils in a bermed, lined (20 mil) and covered (6 mil) stockpile for future characterization and disposal by USACOE.

188

August 2, 1993

Dames & Moore spreads fertilizer at the Biocell.

194

August 8, 1993

Dames & Moore sent USACOE Field Change Notice (FCN) No. 17 requesting expenses incurred during shut down at SWMU 53.

195

August 9, 1993

Dames & Moore received original Notice to Proceed on SWMU 53.

199

August 13, 1993

Dames & Moore received direction from Tim Hudson (Dames & Moore Project Manager) to backfill SWMUs 19 and 20 with the imported (and USACOE confirmed acceptable) clay liner.

202

August 16, 1993

Dames & Moore commenced backfilling operations at SWMUs 19 and 20 with approved clay liner. Dames & Moore collected first round of periodic Biocell progress samples from ten grids (BCU-14 - BCU-26), and the average TPH value was 470 ppm.

204

August 18, 1993

USACOE sent Dames & Moore their response to FCNs No. 1 through 16.

205

August 19, 1993

Dames & Moore completed backfilling the clay liner at SWMUs 19 and 20 and conducted compaction testing of clay which all passed the USACOE specifications.

212

August 26, 1993

USACOE sent Dames & Moore a request to provide a separate proposal for sampling, transport and disposal of identified soil at SWMU 53. USACOE elects to not use Dames & Moore for these services.

CHRONOLOGY OF EVENTS

216 August 30, 1993	USACOE/CAFB (Frank Grey) directed Dames & Moore to plug line "A" at SWMU 53.
217/218 August 31 and September 1, 1993	Dames & Moore loaded, transported (tarpred appropriately) and disposed of 12 loads of concrete rubble from excavation activities of old drainage ditch at SWMU 53. CAFB (Frank Grey) signed all manifests.
219 September 2, 1993	Dames & Moore sent the USACOE all copies of manifests of concrete rubble disposed from SWMU 53. All excavation of impacted soils necessary to be removed only for construction of new drainage system is complete at SWMU 53, and the soil was appropriately stockpiled.
232 September 15, 1993	Dames & Moore received the 66 inch reinforced concrete pipe (RCP) at SWMU 53 and began laying pipe. USACOE sent Dames & Moore letter concerning the volume of soils excavated from SWMUs 19 and 20, transported to the Biocell and undergoing treatment.
234 September 17, 1993	Dames & Moore collected the 2nd round of Biocell progress samples for analysis (BCU-27 - BCU-39).
239 September 22, 1993	Dames & Moore hauled and placed clay backfill to cover the 66 inch RCP at SWMU 53.
241 September 24, 1993	USACOE advises Dames & Moore that after treatment the Biocell soils were to be backfilled where CAFB has their aboveground air venting Biocell.
244 September 27, 1993	Analytical results indicated that the 2nd round of progress samples at Biocell revealed average levels of 211 ppm TPH.

CHRONOLOGY OF EVENTS

- 245  
September 28, 1993  
Dames & Moore ordered 500 pounds of fertilizer (20-20-2) for the Biocell.
- 246  
September 19, 1993  
Dames & Moore spread the 500 pounds of fertilizer on the Biocell. Graham Associates, Inc. surveyed the stockpile at SWMU 53.
- 252  
October 5, 1993  
Graham Associates, Inc. reported to Dames & Moore that the final surveyed volume of stockpiled soils at SWMU 53 were 668 cubic yards.
- 253  
October 6, 1993  
Dames & Moore formed the headwall and bottom slab of the new drainage ditch at SWMU 53. Dames & Moore also excavated new manhole area for Haile Drive at SWMU 53.
- 261  
October 14, 1993  
USACOE showed Dames & Moore the disposal area for the Biocell treated soils. This area is located just past the Nitrogen Facility by the Carswell Golf Course.
- 265  
October 18, 1993  
Dames & Moore collected the 3rd round of Biocell monthly progress samples from the 10 grids for analysis (BCU-40 - BCU-52), and the average TPH value was 64 ppm.
- 272  
October 25, 1993  
Dames & Moore delivered and spread 100 pounds of fertilizer (20-20-2) on Biocell. Periodic sampling cells #4 and #9 received 10 pounds each.
- 273  
October 26, 1993  
Dames & Moore analyzed collected surface water sample collected from Biocell (BC-1) which turned out to have 0.5 ppm TPH and below detection limits for Benzene, Toluene, Ethylbenzene and Xylene (BTEX).

CHRONOLOGY OF EVENTS

275

October 28, 1993

Dames & Moore poured the bottom slab of the new drainage ditch at SWMU 53, finished installed the 6 inch sewer line, and poured the manhole at Haile Drive.

282

November 4, 1993

Dames & Moore conducted 4th periodic Biocell progress sampling of only the two grids (BCU-53 and BCU-54) that exceeded 100 ppm TPH [#4 (121) and #9 (125)], and the average TPH value was 138 ppm.

294

November 16, 1993

Dames & Moore sent proposal for sampling and disposal of stockpiled soils at SWMU 53 to USACOE.

308/309

November 30 and  
December 1, 1993

Dames & Moore (due to last sampling data info at BCU) mobilized and collected verification samples at Biocell (B-1 through B-102; and B-126 to B-136). Dames & Moore finished all concrete work at SWMU 53.

317

December 1, 1993

Dames & Moore sent USACOE a request to use hydro-mulching for the reseeding operations.

318

December 10, 1993

Dames & Moore discusses what to do with elevated TPH levels (EPA Test Method 418.1) in Biocell confirmatory samples. Dames & Moore chose seven highest grids (B-58, 60, 61, 63, 69, 80, and 87) to run total extractable TPH (EPA Test Method 8000) for comparison against EPA Test Method 418.1. Dames & Moore presents proposal to USACOE to load, transport and dispose of soils stockpiled at SWMU 53. The USACOE elects to not utilize Dames & Moore for this work.

323

December 15, 1993

Dames & Moore received confirmation that the seven highest TPH grids of Biocell are all below 100 ppm by EPA Test Method 8000.

CHRONOLOGY OF EVENTS

330

December 22, 1993

USACOE sent Dames & Moore their decision to follow the specification Sections 02933 and 02940 for reseeding operations instead of hydro-mulching.

345

January 6, 1994

Dames & Moore sent USACOE a letter discussing the anomalous TPH values exhibited by the Biocell from the verification sampling conducted on November 30 and December 1, 1993. This letter discussed the TPH analysis method by EPA Test Method 418.1 versus EPA Test Method 8000. Dames & Moore worried about this problem, and that is why we requested to do Bio Bench Scale testing on February 16, 1993, and on July 21, 1993. Dames & Moore notified USACOE that we accept no responsibility for failure to meet cleanup goals since USACOE declined our recommendations. Dames & Moore requested direction on how to proceed with Biocell treated soil from the USACOE.

373

February 3, 1994

USACOE sent Dames & Moore their decision that they would not pay for geotextile liner used at Biocell.

386

February 16, 1994

Dames & Moore set up the Pre-Final Inspection with the USACOE for March 4, 1994.

392

February 22, 1994

Dames & Moore delivered the Certified Payroll Summary as per the contract specifications to the USACOE.

402

March 4, 1994

Dames & Moore conducted the Pre-Final site Inspection with representatives of the USACOE and CAFB for approval to reseed the construction areas.

412

March 14, 1994

USACOE sent Dames & Moore a letter releasing Dames & Moore from further treatment of Biocell soils (after discussions and approval with CAFB and Texas Natural Resources Conservation Commission [TNRCC]); directing Dames & Moore to remove the Biocell, transport treated soil; spread, shape and compact the soil in excavated areas

CHRONOLOGY OF EVENTS

- within SWMUs 19 and 20 with slopes of not more than 1V:3H to allow for reseeding operations.
- 438  
April 9, 1994  
Dames & Moore provided USACOE with the returfing schedule and Notification of Sources submittal.
- 440  
April 11, 1994  
Dames & Moore mobilized to the site and prepared the subsurface, provided topsoil in SWMU 53 and prepared for reseeding operations.
- 446  
April 17, 1994  
Dames & Moore conducted and completed returfing of SWMU 53.
- 447  
April 18, 1994  
Dames & Moore submitted to USACOE a preliminary hard copy of the Biocell verification sampling results.
- 485  
May 26, 1994  
Dames & Moore and USACOE met to discuss Biocell, directions on how to break it down, and backfilling operations for SWMUs 19 and 20.
- 500  
June 10, 1994  
Dames & Moore and USACOE discuss Biocell liner disposal options.
- 503  
June 13, 1994  
Dames & Moore commenced with removal of the Biocell soils to backfill excavated areas of SWMUs 19 and 20 with USACOE, CAFB, and TNRCC approval.
- 518  
June 28, 1994  
Dames & Moore hauled 647 loads of treated soil and 198 loads of clay backfill to SWMUs 19 and 20 from the Biocell. Dames & Moore sampled water (LW-1) collected on Biocell liner which indicated below detection limits for TPH and BTEX. Liner was cut up, and 8 loads of liner material were transported for disposal to Laidlaw Landfill, Fort Worth, Texas.

CHRONOLOGY OF EVENTS

527

July 7, 1994

Graham Associates, Inc. surveyed final backfilled SWMUs 19 and 20. Clay berm material which was stockpiled around the excavation area for later grading was not included in this survey for payment quantities.

533

July 13, 1994

Dames & Moore conducted and completed returfing of SWMUs 19 and 20 today. The turfing maintenance program commenced today.

554

August 3, 1994

Dames & Moore met USACOE and CAFB representatives for Final Inspection. Based on the Final Inspection, the USACOE requested the following: SWMU 53 needs to be mowed; provide the treated soil volume for SWMUs 19 and 20; fertilize and water the returfed areas; sites to be cleaned of rocks/wire; remove sprinkler system; repave small area of haul road; and, provide surveys, certified payroll and manhour reports.

559

August 8, 1994

Graham and Associates, Inc. sent Dames & Moore a certified letter stamped by Charles F. Stork (Registered, Professional Land Surveyor) presenting the treated soil volume estimate based upon survey data collected in two increments. The total volume of loose treated soils was 9,059 cubic yards.

562

August 11, 1994

Dames & Moore submitted to the USACOE the treated soils volume and data from Graham Associates, Inc. along with survey maps which indicated a total of 9,059 treated cubic yards of soils for payment volume.

568

August 17, 1994

Dames & Moore fertilized, watered grass, cleaned sites of wire/rocks, and removed and turned over to CAFB the sprinkler system. Today was the last official physical day Dames & Moore was on site at CAFB.

CHRONOLOGY OF EVENTS

591

September 9, 1994

Dames & Moore transmitted USACOE a final letter concerning the treated soils volumes at SWMUs 19 and 20 which requested the finalized approved amount for payment to be 9,059 cubic yards. This issue was still under discussion with the USACOE.

604

October 24, 1994

Dames & Moore received final Contract Modification (P00012) by the USACOE which finalized the agreed upon soil volumes for payment of 9,562 cubic yards excavated, hauled and stockpiled and 8,894 cubic yards remediated, backfilled, and compacted.

633

November 21, 1994

USACOE accepted and approved the final As-Built Drawings for the project.

721

January 17, 1995

Dames & Moore (Ned Jessup) contacted USACOE (Todd Smith) to discuss when the Final Summary Report of environmental issues would be complete. It was tentatively set for February 7, 1995 with the understanding that if additional time was necessary, Dames & Moore would submit a written request for a time extension.

741

February 6, 1995

Dames & Moore submitted extension request for submittal of the Final Summary Report to the USACOE on February 17, 1995.

752

February 17, 1995

Dames & Moore submitted the Final Summary Report to USACOE and CAFB. This submittal is the last requirement under Contract No. DACA63-93-C-0012, and the contract is considered closed successfully.



**FINAL PAGE**

**ADMINISTRATIVE RECORD**

**FINAL PAGE**

**FINAL PAGE**

**ADMINISTRATIVE RECORD**

**FINAL PAGE**